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THE EVOLUTION, PHYLOGENY, AND CLASSIFICATION OF THE PROBOSCIDEA

BY HENRY FAIRFIELD OSBORN

The following is the quadruple branching indicated in classifications of the Proboscidea previous to 1910 (Osborn, 'Age of Mammals'):

ELEPHANTIDÆ—Gray, 1821; Zittel, 1891

MASTODONTIDÆ—?Mastodonadæ Gray, 1821

DINOTHERIIDÆ—Bonaparte, 1845; Zittel, 1891

MÆRITHERIIDÆ—Andrews, 1906

1.—PRIMARY DIVISIONS

In December 1917, the author presented before the Palæontological Society a paper entitled 'A Long-jawed Mastodon Skeleton from South Dakota and Phylogeny of the Proboscidea.'¹ This included a polyphyletic theory of the Proboscidea more or less fully anticipated by previous authors but more radical. This branching, as extended by Osborn in 1910 and 1917, is as follows:

MASTODONTINÆ—Osborn, Age of Mammals, 1910, p. 558

ELEPHANTINÆ—Osborn, Age of Mammals, 1910, p. 558

BUNOMASTODONTINÆ—Osborn, 1918, p. 134. Defined to contain three main phyla, originally termed (Osborn, 1918, p. 136): 1, Longirostrinæ; 2, Rhynchorostrinæ; 3, Brevirostrinæ

STEGODONTINÆ—Osborn, 1918, p. 135 = Stegodonts of southern Asia

LOXODONTINÆ—Osborn, 1918, p. 135 = African and Eurasiatic loxodonts

EUELEPHANTINÆ²—Osborn, 1918, p. 136 = Mammoths of Eurasia and North America

Of the above branches it now appears that the Bunomastodontinæ is a group rather than a subfamily and must be split up into the three subfamilies provisionally termed (1, 2, 3) above. Adding the *Mæritheriidæ* and the *Dinotheriidæ*, this would divide the Proboscidea into ten branches.

¹Bull. Geol. Soc. Amer., XXIX, No. 1, March 1918, pp. 133-137.

²The term Euelephantinæ is invalid, because the genus *Euelephas* is invalid; the term *Mammontinæ* (i. e., *les mammons*, the mammoths) may be substituted.

In continuing the study of the Proboscidea since 1917, aided by recent observations of Lull, Matthew, Mayer, Schlesinger, Pilgrim, Barbour, and many others, it is the opinion of the author that the phyphyletic theory of the Proboscidea is not only confirmed but that the phyla are more numerous than the ten branches already named and are geologically far more ancient than appeared in 1917.

As regards the rank of the four primary divisions of the Proboscidea which have hitherto been discovered, they are certainly more profound than the four sections of the Rodentia, viz.: I, Sciuromorpha; II, Myomorpha; III, Hystricomorpha; IV, Lagomorpha. They are also more profound than Osborn's four main divisions of the Perissodactyla, viz.: I, Titanotheroidea; II, Hippoidea; III, Tapiroidea; IV, Rhinocerotidea.

With the reservations, first, that we should not expect to find different orders of mammals subdivided into branches of equal rank and, second, that the subdivisions of the Proboscidea are either of subordinal or of superfamily value, we may adopt as the four primary divisions:

- I. MÆRITHERIOIDEA typified by the *Mæritherium* in the Oligocene of North Africa
- II. DINOTHERIOIDEA typified by the Miocene and Pliocene *Dinotheres* of Eurasia
- III. MASTODONTOIDEA to include the *Bunomastodontida*, new family, and the *Mastodontida*
- IV. ELEPHANTOIDEA to include the *Elephantina*, *Loxodontina*, *Stegodontina*, and *Mammontina*

I.—Mæritherioidea

Renewed study of *Mæritherium* by Osborn and Matsumoto entirely confirms Andrews' original opinion that *Mæritherium* belongs in the order Proboscidea, as well as Osborn's opinion that it stands very far apart from the other proboscideans and is not directly or indirectly ancestral to either of the other three groups. The enlargement of the second upper and lower incisor teeth into mutually abrading tusks, girdled with enamel, presents a firm ground of affinity with a still unknown primitive Lower Eocene proboscidean stem form. There the resemblance ends. These Mæritheres had no proboscis. The face, of brachyopic type, is markedly abbreviated. The cranium is elongated. Thus the facial and cranial proportions are analogous to those of the *Sirenia*. The upper grinding teeth are bilophodont, pointing to a tetrabunodont ancestry, and different from the bunomastodont grinders of *Palæomastodon*, which point to a hexabunodont ancestry. The lower grinders exhibit a rudimentary third crest. Andrews' opinion that the Mæritheres were amphibious is probably correct.

II.—Dinotherioidea

All agree that these animals were chiefly fluviatile and amphibious in habit, in this respect resembling *Mœritheres* but differing in the entire loss of the superior incisor teeth. Early loss of upper tusks released the inferior. In the downturning of the inferior tusks the *Dinotheres* are paralleled by the *Rhynchostrinæ* among the *Mastodontoidea*. In skull

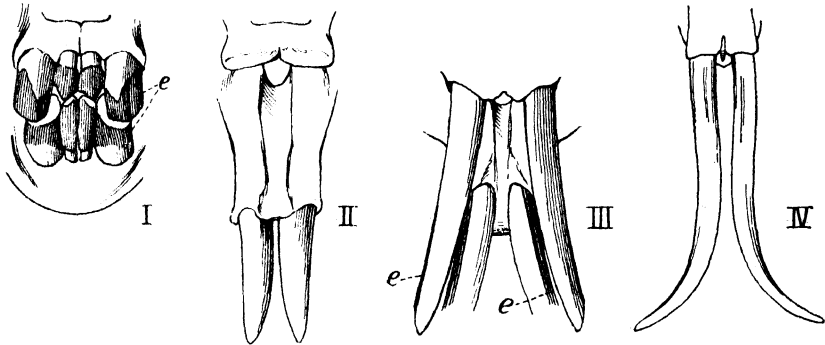


Fig. 1. Fundamental arrangement of the cutting teeth in the four superfamilies of the Proboscidea.

I.—*Mœritherium*. II.—*Dinotherium*. III.—*Rhynchotherium*. Composition of two species. IV.—*Sægodon*. *S. insignis* stage. Scale not uniform.

form and in limb and foot structure the *Dinotheres* parallel the true proboscideans. They diverge very widely from proboscideans in the evolution of the upper and lower grinding teeth. The primitive *Dinotheres* present simple bilophodont grinders, similar to those of *Mœritherium*, and are persistently bilophodont. The upper grinders attain a stage which parallels the molar pattern of the tapir (*Tapiroides*) among the perissodactyls, but shows no tendency to the trilophodont, tetralophodont, or polylophodont structure characteristic of the mastodons and elephants.

III.—Mastodontoidea

The fundamental character of the front teeth in this superfamily is seen in primitive members of the *Rhynchostrinæ* and *Longirostrinæ*, namely:

- Second superior incisors enlarged, downturned, divergent, with enamel band on the outer side only.
- Second inferior incisors downturned (as in *Dinotheres*) with enamel band on outer side (*Rhynchostrinæ*) or procumbent with no enamel band (*Longirostrinæ*).

The important functional distinction is that for a very long period of time the upper tusks abraded the outer side of the lower tusks; this probably explains the retention of the superior enamel band. In certain lines (Longirostrinæ) the procumbent lower incisors persist and the upper incisors retain their primitive downcurved position as in *Palæomastodon*. In other lines (Mastodontinæ, Brevirostrinæ) the lower incisors practically ceased to function; the upper incisors finally turn upward and inward, but may retain the enamel band for a long period (Mastodontinæ, *fide* Schlesinger, and Brevirostrinæ, *vide* *M. andium*).

A distinctive character of the grinding teeth of the Mastodontoidea is some evidence of the descent from a hexabunodont ancestral grinder (i. e., with intermediate tubercles or conules) as distinguished from the tetrabunodont ancestral type of Mœritheres and Dinotheres. The rudiments of ancestral conules gave rise to various trefoils or paired median outgrowths or crests, so characteristic of all the Bunomastodontidæ whether beak-jawed (Rhynchorostrinæ), or long-jawed (Longirostrinæ), or short-jawed (Brevirostrinæ). In each of these subfamilies the grinders independently undergo a more or less closely parallel evolution, evolving single trefoils in Upper Oligocene and in Miocene time, and double trefoils in Pliocene time.

Unlike the Mœritheres and Dinotheres, the three intermediate molars (i. e., fourth premolar and first and second true molars) invariably become trilophodont, while the third true molars become tetralophodont. At this point there is a divergence into (1) Mastodontidæ, purely forest living, brachyodont, with simply crested teeth, in which the intermediate molars are persistently trilophodont, with arrested trefoils, and into (2) Bunomastodontidæ, which pass into tetralophodonty and polylophodonty in some lines, with evolving trefoils. The grinder evolution is adapted to a leaf-browsing habit, in distinction to the prevailing grazing habit developed among the elephantoids. The development of hypsodonty, and chærodonty (Schlesinger), among these (longirostrine and brevirostrine) browsers is analogous to that in the hippopotami and the hypsodont suillines.

IV.—Elephantoidea

One prime distinction in this superfamily is the very early complete loss of the lower incisor teeth, accompanied by the early development of the upper incisors into horizontal or upturned tusks finally devoid of enamel except at the tips in the young stage. Vestigial enamel bands are recorded in early stages of the stegodonts. A second distinctive

character is the absence of conule development into trefoils, so characteristic of the mastodontoids, and the early tendency to form evenly transverse, more or less mammillate, crests which become in the highest degree hypsodont and polylophodont in adaptation to chiefly grazing habits.

2.—EVOLUTION AND PHYLOGENY OF FAMILIES AND SUBFAMILIES

The phylogeny of species is now partly known; the Miocene phyla of Europe are being studied by Schlesinger. Systematic classification will follow a full understanding of the evolution and phylogeny. Forty-four generic names have been proposed for these animals and, as yet, an uncounted number of specific names. Generic and specific synonymy awaits (1) a clear separation of the phyla, (2) a determination of the precise geologic levels of types, and (3) a fuller knowledge of all the characters of the species. None of these data is complete as yet, hence the present contribution is preliminary to the author's revision of the synonymy.¹

We await also a restudy by Matsumoto of the characters of the *Mæritheres*, soon to be published in the American Museum Bulletin, also a fuller knowledge of the *Dinotheres* from unpublished materials in the British Museum. The positive determination of supposed south Asiatic relatives of *Mæritherium*, as well as of *Palæomastodon*, is very important. Pilgrim (1910, p. 67) provisionally refers to *Mæritherium* a small, primitive proboscidean molar from the Bugti Hills, Upper Oligocene. In the same beds occur *Hemimastodon crepusculi*, a longirostrine more recent in type than *Palæomastodon*. Ancestors of the Rhynchostrines and of the true Mastodontines should also be sought in southern Asia.

The Rhynchostrinae

The type of this subfamily (*Rhynchotherium* Falconer, 1868) is a cast (observed in the Genoa Museum by Falconer) of a lower jaw from the Valley of Mexico; the jaw at the time had no specific or generic name. The original genotype may be termed *Rhynchotherium tlascalæ*, new species, from the locality Tlascalá. A similar specimen from Mexico is in the American Museum (Fig. 2 C). The present known range of these animals is Mexico (*R. tlascalæ*), California (*R. shepardi* Leidy), Colorado (*R. brevidens* Cope), and Kansas (*R. euhypodon* Cope). It is note-

¹There is in preparation an iconographic revision of the known species of Proboscidea to be published in the American Museum Memoirs.

worthy that the Rynchorostrines are geologically the earliest forms of proboscideans known in America, i. e., *R. brevidens*, *R. proavus*. The presence of a species of this subfamily in Middle Miocene beds was recently confirmed by Loomis.

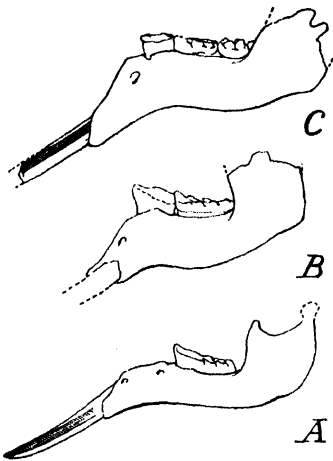


Fig. 2. Rynchorostrine types of lower jaw.

A.—*Rhynchotherium euhypodon* Cope.
B.—*R. shepardi* Leidy. C.—*R. tlascalæ*,
new species. All figures $\frac{1}{2}$ natural size.

The most distinctive feature of this phylum is the downturning of the symphysis, hence the name *Rhynchotherium*, or beak-jawed. A second distinction is the retention of the enamel bands on the lower tusks, to which the specific name *euhypodon* Cope (i. e., perfect lower teeth) refers. A third distinctive character is the relative simplicity and small size of the third grinders, hence the specific name *brevidens* Cope, applied to the most ancient form discovered in America. It would appear that the retention of effective upper and lower tusks relieved the grinding teeth in which the evolution is relatively slow. The known geologic succession of species is:

- Rhynchotherium tlascalæ*, new species, 1921. Valley of Mexico
- “ *dinotherioides* Andrews, 1909. N. W. Kansas. Pliocene
- “ *euhypodon* Cope, 1884. Lower Pliocene of Kansas
- “ *shepardi* Leidy, 1871. Stanislaus County, California. ?Miocene
- “ *brevidens* Cope, 1889. Middle Miocene, Deep River, Oregon
- ? “ *proavus* Cope, 1873. Middle Miocene, Pawnee Creek, Colorado

The maxilla is partly downturned, as well as the mandibular symphysis. Both the superior and inferior incisors are laterally compressed, bending downward and outward. The grinding teeth remain relatively simple, brachyodont, with posterior grinders not exceeding four and a half crests. The intermediate grinders are trilophodont. The grinding series is reduced to $\frac{2}{3}$, $\frac{1}{3}$ as in *M. mirificus*.

The Longirostrinæ

This is the most complete and ancient proboscidean phylum known. The four more or less complete skeletons of *T. angustidens*, *T. productus*, and *T. giganteus* prove that these were low-bodied animals, with ex-

tremely broad plevs and short heavy limbs. In the later phases of their evolution they were probably savanna- and stream-dwellers less closely confined to the forests than the Mastodontinæ. The extraordinary traveling powers of this family prove that they were well fed and well defended. The geologic and geographic range is indicated in the following partial list of species. There is an undoubted division of the family into three or four separate phyla, as follows:

I	II	III
Typical Longirostrines:	Somewhat broader	Without typical tre-
Long, narrow inferior	teeth; with typical	foils; Miocene and
teeth; with typical tre-	trefoils; Miocene of	Pliocene of America.
foils; Oligocene to Plio-	Europe.	E. g., <i>T. serridens</i> Cope.
cene. E. g., <i>T. angustidens</i>		
Cuvier and its successors.		

Directly ancestral to phylum I appears to be *Palæomastodon wintoni* of the Fayûm Oligocene. The phyla I and II are still to be clearly distinguished in the Miocene of France. Phylum III first appears in the Upper Miocene of America but will probably be found in southern Asia as well as in France.

I. *T. ANGUSTIDENS* PHYLUM

PLIOCENE STAGES, double trefoils, intermediate molars four-crested.

Tetralophodon campester Cope, 1878. Republican River, Kansas.

" *longirostris* Kaup, 1835. Eppelsheim, Germany.

" *punjabiensis* Lydekker, 1886. Middle Siwaliks, India; Dhok Pathan.

" *corrugatus* Pilgrim, 1913. Lower Pliocene, India.

MIOCENE AND LOWER PLIOCENE STAGES, intermediate molars three-crested, single trefoils.

Trilophodon macrognathus Pilgrim, 1913. Middle Miocene, upper Chinji, India.

" *giganteus*, new species, 1921. South Dakota.

" *floridanus* Leidy, 1886. Lower Pliocene, Florida.

" (*Megabelodon*) *lulli* Barbour, 1914. Snake River, Nebraska.

" (*Tetralodon*) *osborni* Barbour, 1916. Near Bristow, Nebraska.

" (*Tetralodon*) *willistoni* Barbour, 1913. Nebraska.

" (*Mastodon*) *obscurus* Leidy, 1869. Miocene, Maryland.

" (*Mastodon*) *productus*, Cope, 1874. Upper Miocene, Clarendon, Texas.

" *angustidens palæindicus*. Manchhar, Middle Miocene, India.

Trilophodon angustidens Cuvier. Type. Simorre, Middle Miocene, France.

" *pygmæus*. Lower Miocene, Africa.

UPPER OLIGOCENE, North Africa, India.

Hemimastodon (Tetralodon) crepusculi Pilgrim, 1912. Upper Oligocene. Bugti, Sind.

Palæomastodon wintoni Andrews, 1905. Upper Oligocene, Egypt.

III. *T. SERRIDENS* PHYLUM

Trilophodon (Mastodon) serridens Cope, 1884. Upper Miocene, Clarendon, Texas.

" (*Tetralodon*) *serridens cimarronis* Cope, 1893. Miocene, Clarendon, Texas.

" (*Dibelodon*) *præcursor* Cope, 1893. Blanco, Middle Pliocene, Texas.

? " *turicensis* Schinz. Middle Miocene, France.

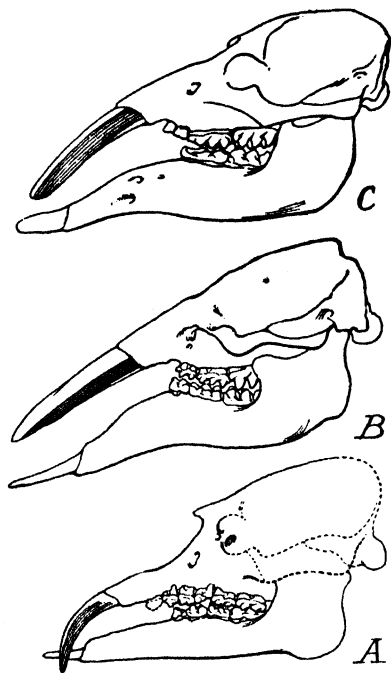


Fig. 3. Longirostrine types of jaw and skull.

A.—*Palæomastodon wintoni* Andrews.
B.—*Trilophodon serridens* Cope. C.—*Trilophodon productus* Cope. Scale not uniform.

In the typical Longirostrines (I) the lower jaws progressively elongate; rapidly attain great length in some of the European and American Miocene species, e. g., *T. lulli*, *T. giganteus*; relatively less elongate in the Pliocene species *Tetralophodon longirostris* and *T. campester*, as shown in the accompanying figure (Fig. 4). Throughout, the inferior incisors are without enamel band, spatulate, progressively flattened, horizontally appressed, more or less elongate; as the jaw swings abrading the dentine and inner side of the enamel bands of the superior tusks; the latter are rounded and slightly compressed, never oval as in *Rhynchotherium*. In *T. giganteus*, new species (Fig. 4 C), the two lower tusks turn toward each other.

A characteristic, of all the Miocene grinders observed, is the presence of a single trefoil invariably appearing first on the inner side of the upper teeth and on the outer side of the lower teeth. The double trefoils

(inner and outer) on the upper and lower grinders first appear in the uppermost Miocene and Lower Pliocene stages. The intermediate molars in all Miocene species observed are three-crested; hence these animals fall within the genus *Trilophodon* Falconer. The transition to the four-crested stage is observed in Upper Miocene types of Europe by Schlesinger. In all Pliocene species observed the intermediate molars are four-crested; hence they fall within the genus *Tetralophodon* Warren, Falconer. From the Middle Miocene apparently to the close of the Middle Pliocene there was a steady addition of crests to $m \frac{3}{4}$, rising from four and a half crests in the Middle Miocene (*T. angustidens*) to seven and a half crests in the Middle Pliocene (*T. barbouri*, new species). At the same time the crests become subhypsodont partly coated with cement.

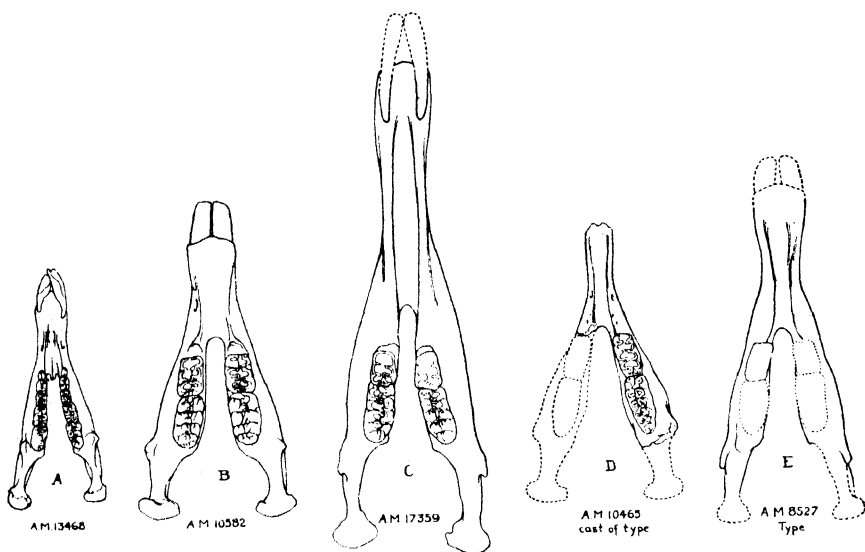


Fig. 4. Lower jaw and grinding teeth in the longirostrine phylum.

A.—*Palgomastodon wintoni* Andrews. Amer. Mus. No. 13468. B.—*Trilophodon productus* Cope. Amer. Mus. No. 10582. C.—*Trilophodon giganteus*, new species. Type, Amer. Mus. No. 17359. D.—*Tetralophodon longirostris* Kaup. Drawn after cast of type. Amer. Mus. No. 10465, Warren Collection. E.—*Tetralophodon campester* Cope. Type, Amer. Mus. No. 8527. All figures $\frac{1}{2}$ natural size. Grinding teeth in C, *Trilophodon giganteus*, foreshortened in drawing.

There is no evidence that any of the typical Longirostrines (I) were transformed into Brevirostrines by jaw-abbreviation. But it would appear that from certain atypical long-jawed forms (perhaps from phylum II of France with broader molar teeth) arose the *Eubelodon morrilli* type of Barbour, to be described below, without lower tusks, of the Lower Pliocene, Devil's Gulch, Nebraska.

TWO NEW SPECIFIC STAGES.—A new specific stage more recent in character than *T. floridanus* Leidy appears to be represented in the skeleton and jaws (Amer. Mus. No. 17359) discovered in South Dakota by E. L. Troxell in 1916, to which the name **Trilophodon giganteus**, new species, may be applied. It exhibits rudiments of double trefoils and the lower incisors are upturned at the sides so as to face partly inward (Fig. 4 C). A second new species is the **Tetralophodon barbouri**, of which the type (Neb. State Mus. No. 4.22.6.16) is a grinding tooth with double trefoils, seven and a half to eight crests, and cement; thus advanced much beyond *T. campester* with six and a half crests on the superior grinders, without cement.

The Brevirostrines of South America

It now appears that the South American Brevirostrines, *M. andium* and *M. humboldtii*, were not derived directly from the Eurasiatic Brevirostrines, typified by the Eurasiatic *M. arvernensis* and *M. sivalensis*, nor were the South American forms descended from the *M. mirificus* Leidy, which appears to be an Eurasiatic migrant.

The reason for this opinion is that the molar pattern of *M. andium* and *M. humboldtii* is of simple bunomastodont type, with single trefoils (*M. andium*) and double trefoils (*M. humboldtii*), a type familiar in the typical American Longirostrines and Rhynchorostrines only. The Eurasiatic Brevirostrines and the American *M. mirificus*, on the other hand, have molar grinding teeth which Schlesinger aptly terms *charodont* (pig-like, covered with tubercles).

Another typical longirostrine character in *M. andium* is the broad enamel band on the superior tusks. It is not known in any European Brevirostrine. Consequently, it appears probable that the South American bunomastodonts independently abbreviated the jaw and that they may possibly be related to the only American form known in which the jaw is abbreviated, namely, *Eubelodon morrilli* Barbour. The phylum thus appears to be as follows:

Mastodon humboldtii Cuvier. Lower Pliocene

“ *andium* Cuvier. Upper Pliocene. Andean region

“ (*Dibelodon*) *tropicus* Cope, 1884. Valley of Mexico

“ *successor* Cope, 1892. Blanco, Middle Pliocene, Texas

?*Eubelodon morrilli* Barbour, 1913. Devil's Gulch, Lower Pliocene, Nebraska

Eubelodon morrilli exhibits an abbreviated lower jaw, no lower tusks, superior tusks without enamel band (Barbour, 1920). Thus it differs from *M. andium* in one important character, namely, in the absence of the enamel band.

The Brevirostrines of Eurasia and North America

Suddenly in the Lower Pliocene of the Siwaliks, India, appears *M. hasnoti* Pilgrim, in the Dhok Pathan horizon, stage of Pikermi, of Eppelsheim. According to Pilgrim this differs from the true *M. sivalensis* Falconer of the Middle Pliocene, Tatrot horizon, in having $m\frac{2}{3}$ tetralophodont and in the slightly marked alternation of the cones. The Middle Pliocene *M. sivalensis* has a pentalophodont $m\frac{2}{3}$ and the cones are more alternate. The closely related Brevirostrine (*M. arvernensis*) of southern Europe ranges from the lignites of Casino (Middle Pliocene) to the First Interglacial stage in England (Crag). Similarly, the *M. mirificus* of Leidy was first described in association with *Elephas imperator* and determined by Hay as of the Aftonian, i. e., First Interglacial stage. The known succession of described forms in these browsing, forest-living elephants of the warm zones is as follows:

- Mastodon arvernensis*. Norwich fluviomarine crag, Norfolk, England
- " *arvernensis* Croizet et Jobert. Typical. Upper Pliocene of Auvergne
- " *mirificus* Leidy. Typical of *E. imperator-Equus* zone of Nebraska
- " *chapmani* Hays, 1834. Geologic level unrecorded
- " *sivalensis* Falconer. Tatrot horizon, Middle Pliocene, Siwaliks, India
- " *brevirostris* Gervais, 1846. France
- " *pentelici* Wagner. Pikermi, Lower Pliocene, Greece
- " *hasnoti* Pilgrim. Dhok Pathan horizon, Lower Pliocene, India

The unique feature of the members of this phylum is the alternation of the inner and outer cones of the grinding teeth, which are placed obliquely instead of opposite each other. A further distinctive character is the brevirostral, brachycephalic skull, which parallels that in all the Elephantoida. The jaws rapidly abbreviate and lose the lower tusks in an early stage. The upper tusks, at first elongate and horizontal (*M. arvernensis*), are upturned and out-turned (*M. mirificus*). No enamel band has been observed. The grinding action of the teeth, like that of the pigs, peccaries, and hippopotami, explains the early evolution of double trefoils and finally of accessory tubercles; hence the apt term chœrodont, applied by Schlesinger. The intermediate grinders, at first trilophodont, become tetralophodont (*M. hasnoti*), pentalophodont (*M. sivalensis*). The posterior grinders $m\frac{2}{3}$ evolve six and a half crests (*M. arvernensis*), the cones becoming subhyposodont.

Within the Brevirostrinae are at least two phyla: I. *Mastodon arvernensis*, termed *Dibunodon* by Schlesinger; and II. *Mastodon pentelici*, termed *Chœrolophodon* by Schlesinger, with a longer symphysis, represented in Samos and in Maragha, Persia. III. To a third

phylum may belong *M. hasnoti*, *M. sivalensis*, India (see Schlesinger,¹ pp. 224-229), *M. mirificus*, North America.

The Mastodontinæ

Forest-living animals are rarely found fossil, e.g., the forest-living Chalicotheres of the entire Tertiary. The massive, low-bodied, low-headed, well-defended Mastodontinæ probably evolved chiefly in the north temperate forests of Eurasia. That they were cold-loving animals is shown by their avoidance of southern Eurasia, except for the single appearance of *M. borsoni* in the Upper Pliocene of the Val d'Arno in northern Italy. Of one of the oldest known forms (*M. tapiroides* Cuvier) of the Middle Miocene of France, according to Schlesinger, occasional descendants are found in Europe. All are zygalophodont; the cones of the grinders turning into transverse crests, the intermediate conules remaining rudimentary, no trefoils forming. Superior incisors (Miocene) retain enamel bands (Schlesinger), but, released from apposition with the lower incisors, turn upward and outward; the lower incisors persisting as abbreviated, horizontal, rounded tusks. The jaws and skull abbreviated, brachycephalic. Intermediate grinders persistently trilophodont. Posterior grinders progressing to a tetralophodont stage only. The vertical chopping motion of the jaws, as distinguished from the grinding motion in the Longirostrines and the Brevirostrines, explains the retention of simple crests and the non-development of trefoils and tubercles.

All ancestral stages will doubtless be found in northern Eurasia. The *M. borsoni* of the Upper Pliocene forests extends into Russia and is directly or indirectly ancestral to the *M. americanus*, a Pleistocene arrival in North America. The chief known specific stages are:

- Mastodon americanus*. Pleistocene
- “ *progenium* Hay. Missouri Valley, Iowa
- “ *borsoni* Hays. Upper Pliocene, Val d'Arno, Italy
- ? “ *turicensis* (*tapiroides*). Middle Miocene, Sinorre, France
- ? “ *pyrenaicus*. Middle Miocene, France
- “ *tapiroides* Cuvier. Middle Miocene, France

These six outstanding species are doubtfully placed in one phylum awaiting further evidence.

The Stegodontinæ of Southern Eurasia

We observe that the Stegodonts are persistent browsers, probably tropical, forest-living proboscideans. According to Pohlig, from the

¹1917, Denksch. K. K. Naturhist. Hofmuseums, I, Geol.-Paläontol., Rheide 1, pp. 1-230.

skeleton discovered in Trinil, Java, they have short, massive bodies like those of the Mastodontinæ of the north temperate forests. The skull and tusks do not lead into either the Elephantinæ or the Mammontinæ types. The phyletic succession of species is clarified by Pilgrim's geologic subdivisions of the Siwaliks and by his observations on the succession of specific types, which provisionally may be arranged as follows:

- Stegodon ganesa* (male), *S. insignis* (female). Upper Pliocene and Lower Pleistocene, southeastern Eurasia
 “ *stegodontoides* Pilgrim, 1913. Lehri, Upper Siwaliks. ?Middle Pliocene
 “ *cliftii* Falconer. Dhok Pathan horizon, Lower Pliocene, India
 “ *bombifrons* Falconer. Dhok Pathan, India
 “ *cautleyi* Lydekker. Perim Island. Upper Miocene
 “ *latidens* Clift. Irawadi River, Asia

The distinctive feature of the grinding teeth is the rapid multiplication of transverse crests which rise from the formula 4.5.6.6.7-8 in *S. cliftii* (Lower Pliocene) to 5.9.10.12.13 in *S. insignis* (Lower Pleistocene). Jaw rapidly abbreviated. Upper tusks straight, parallel, slightly up-curved (adapted to dense forests). Grinders brachyodont to subhypso-dont, crests breaking up into small mammillæ, valleys filling with cement.

The Loxodontinæ

The late appearance (Upper Pliocene) of these Loxodonts in Italy, the dwarfed evolution in all the Mediterranean islands, the still later geologic appearance (Lower Pleistocene) in Asia, and the existing exclusive occupation of Africa by a great variety of Loxodonts, point to Africa as the original center of adaptive radiation of the Loxodontinæ. This phylum is abundant in the Pleistocene of northern Africa, e.g., *L. atlanticus*.

There is, on the other hand, no trace of these animals in the Pliocene Siwaliks of India; Pilgrim records the first occurrence of *L. antiquus namadicus* in the Lower Pleistocene of Godávári and Nerbada, which also contains *Stegodon ganesa* and *S. insignis*.

The gigantic, wide-spreading upper incisors implanted in the maxillo-premaxillary rostrum are quite distinct from those of either the Stegodontinæ, Mammontinæ, or Elephantinæ. The height attained at the shoulder (*L. namadicus*) is estimated at sixteen feet (Pilgrim), five feet taller than the existing *L. africanus*. The affinity of *L. namadicus* to *L. antiquus* (Upper Pliocene to Middle Pleistocene, Europe) and to *L. africanus* has been pointed out by Falconer, Leith Adams, Pohlig, and Pilgrim. Within the subfamily Loxodontinæ there are a great number

and variety of species undoubtedly belonging to more than two phyla, namely:

- | | |
|------------------------------|--|
| <i>Loxodonta africanus</i> . | Recent, Africa, including fifteen species and subspecies |
| " <i>antiquus</i> . | Upper Pliocene to Middle Pleistocene, Europe |
| " <i>namadicus</i> . | Lower Pleistocene, India and southern Eurasia |
| " <i>creticus</i> | } Mediterranean Islands |
| " <i>melitensis</i> | |
| " <i>mnaidriensis</i> | |
| " <i>atlanticus</i> . | Pleistocene of northern Africa |

Another fossil member of this race has recently been recorded in German West Africa.

The Mammontinæ. The Mammoths

It is a striking fact that the oldest geologic appearance of a member of the true Elephantoidæ is the *Elephas planifrons* occurring in the Pinjor horizon, Upper Siwaliks, Middle to Upper Pliocene, India. All the fauna of the great Siwalik deposits underlying this geologic level, according to Pilgrim, contain only Stegodonts, Longirostrines, and Brevirostrines. This is significant of a north Eurasiatic center of adaptive radiation of both the Mammontinæ and the Elephantinæ. The chief distinction between these two subfamilies lies in the flattened forehead of the Mammoths, to which the specific name *planifrons* refers, a forehead which becomes increasingly concave and compressed antero-posteriorly until it reaches the high, narrow peak of *E. imperator*.

Again, the succession of species is probably polyphyletic, awaiting analysis. In descending order the main geologic succession is as follows:

- | | |
|----------------------------|--|
| <i>Elephas primigenius</i> | Blumenbach. Northern Eurasia and North America,
Upper Pleistocene |
| " <i>columbi</i> | Falconer. Middle Pleistocene, North America |
| " <i>imperator</i> | Leidy. Lower Pleistocene, North America |
| " <i>trogontherii</i> | Pohlig. Lower Pleistocene, Europe |
| " <i>hysudricus</i> | Falconer. Uppermost Pliocene, India |
| " <i>meridionalis</i> | Nesti. Upper Pliocene, Val d'Arno, Italy |
| " <i>planifrons</i> | Falconer. Pinjor horizon, Middle to Upper Pliocene, India,
also Austria and Bessarabia (Russia) |

The position of *E. hysudricus* in this phylum is doubtful. The cranium referred to this species by Falconer is not of the mammontine type. In 1913 Pilgrim traced back *E. planifrons* to the Upper Miocene *Stegodon cautleyi*, but it would appear at present that none of the known Stegodonts gave rise to the Mammoths. Extreme cranial abbreviation,

hyperbrachycephaly, and acrocephaly are great characteristics of all the phyla in this subfamily (excepting possibly that to which *E. hysudricus* belongs). There is a wide range of divergence in the thickness and multiplication of the lamellæ of the grinders. *Elephas imperator* may be derived from the *E. meridionalis* type, with very few lamellæ, composed of thick enamel bands and with a great coating of cement, or from the *E. planifrons* Falconer type. The *E. primigenius* phylum presents the highest lamellar formula known, with relatively little cement; this phylum is also distinguished by the loss of a digit in the pes, becoming tetradactyl, a unique character among proboscideans. Very great shoulder height, estimated at thirteen feet, is attained by *E. imperator* in the favorable environment of the southern United States and Mexico, as compared with the height of nine feet six inches attained by *E. primigenius* in the frigid north.

The Elephantinæ

Like the Mammoths, these animals suddenly appear in the Upper ~~Pliocene~~ of India. They are not found in the Lower Pleistocene, where their place in the fauna is taken by the invading loxodont, *L. namadicus*. In distinction from the Mammoths, the forehead is prominent, convex, in adults highly convex. The upper tusks extend forward and outward, slightly upcurved, not crossing each other in old age as in the more recent Mammoths *E. primigenius* and *E. imperator*. Unlike *E. primigenius*, five digits persist on the fore and hind feet. Skull brachycephalic. Jaws abbreviated. Vestigial lower incisors, enamel remaining on the tips only in young stages. Mammillæ more numerous than in the Loxodonts; less numerous than in *E. primigenius*.

The Unknown Home of the Elephantoidæ

It appears from the above preliminary studies that the proboscidean phylogeny is still subject to many emendations, transpositions, and corrections. It is in the rocks of the great unexplored regions of Eurasia and of Africa—nearly a hundred-fold greater than the regions explored and known—that we must look for the ancestry of the four great branches of the Elephantoidæ, namely, the Stegodonts, the Loxodonts, the Mammoths, and the true Indian elephant type.

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DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM BOLIVIA, BRAZIL, AND VENEZUELA

BY FRANK M. CHAPMAN

The material on which this paper is based is contained in the American Museum and in a small collection recently submitted to us for determination by Dr. Emilia Snethlage of the Museu Goeldi at Pará.

The color terms employed are those of Ridgway's 'Color Standards and Color Nomenclature' (Washington, 1912).

Capito brunneipectus, new species

SPECIFIC CHARACTERS.—Upperparts resembling those of *Capito auratus auratus*, but male with the throat pale cinnamon-buff, breast ochraceous tawny, abdomen light yellowish olive widely margined with greenish yellow; no wing-bars. Female with the throat and breast richer, the former spotted with black, the greater wing-coverts, except terminally, externally margined with old gold.

TYPE.—No. 13709, Museu Goeldi, ♂ ad., June 16, 1917, Villa Braga, Rio Tapajoz, Brazil; Emilia Snethlage.

DESCRIPTION OF MALE.—Entire crown shining old gold, browner on the forehead, yellower on the nape; cheeks, sides of the nape, and back black; interscapulars widely margined with lemon-yellow forming two lines from the nape to the lower back, the latter and rump margined with greenish yellow; tail olivaceous, nearly uniform; wings fuscous, all but the outer quills externally margined with dark citrine, the larger part of the outer web of the tertials olive-buff; lesser and median coverts shining blue-black like the back; greater and primary coverts duller; lower coverts and inner margins of quills buffy; throat and sides of the neck pale cinnamon-buff unmarked; breast-band deep buckthorn-brown narrowly tipped with greenish yellow; feathers of the rest of the underparts broadly tipped with greenish yellow not wholly concealing their olivaceous bases; tibiae with less yellow, ventral region whiter; lower tail-coverts olive tipped with whitish; feet plumbeous; bill black, a horn-colored band at the base of the mandible. Wing, 81.5; tail, 48; tarsus, 22.5; culmen, 21.5 mm.

DESCRIPTION OF FEMALE.—Similar to the male but with the margins of the interscapulars duller, the interscapulum and lesser wing-coverts more or less yellow margined; the greater coverts externally olive-citrine, except at the tip; the throat and sides of the neck with numerous round black spots forming a narrow malar streak, the breast-band deeper, argus-brown; the abdominal region somewhat more olivaceous. Wing, 79-82; tail, 50-54; tarsus, 21-21.5; culmen, 20.5-21.5 mm. (3 specimens).

SPECIMENS EXAMINED.—*Capito brunneipectus*. Brazil: type locality, 1 ♂, 3 ♀♀. *Capito auratus auratus*. Colombia: Buena Vista, 2 ♂♂, 5 ♀♀.

The discovery of this bird not only adds a very distinct species to the genus *Capito* but extends the known range of the genus into the southern part of lower Amazonia. It also gives further emphasis to the apparently restricted areas occupied by certain strongly marked species of this group. Thus *Capito squamatus* is known only from western Ecuador and southwestern Colombia; *C. quinticolor* from western Colombia; *C. hypoleucus* from the Cauca-Magdalena Fauna of Colombia; *C. dayi* from Porto Velho on the Rio Madeira; and *C. brunneipectus* from Villa Braga on the Rio Tapajoz.

In view of the antiquity of the genus to which they belong, can it be possible that the restricted ranges of these birds indicates that they are disappearing species?

***Nonnula amaurocephala*, new species**

SPECIFIC CHARACTERS.—Most nearly related to *Nonnula ruficapilla* (Tsch.), but sides of the head and neck, as well as crown, deep burnt sienna.

TYPE.—No. 12490, Museu Goeldi, ♂ ad., July 18, 1916, Manacapurú, Rio Solimões, Brazil; F. Lima.

DESCRIPTION OF MALE.—Entire head, including nape, lores, eye-ring, auriculars, and sides of the neck rather deep burnt sienna, becoming light Sanford's brown on the underparts and ochraceous buff on the flanks; the lower abdomen, ventral region and under tail-coverts white; back dull, Brussels-brown; remiges basally the color of the back, blacker apically except on the outer feathers which are uniform; wing-quills like rectrices, the inner quills lightly margined with buckthorn-brown; greater, median and lesser wing-coverts like the back; bend of the wing ochraceous orange; lining of the wing ochraceous buff; feet blackish brown; bill black, the mandible yellowish except at the tip and sides. Wing, 61; tail, 52; tarsus, 14; culmen (broken).

DESCRIPTION OF FEMALE.—Similar to the male but underparts somewhat paler. Wing, 63; tail, 55.5; tarsus, 14; culmen, 25 mm.

SPECIMENS EXAMINED.—*Nonnula amaurocephala*. Brazil: type locality, 1 ♂, 1 ♀.

Nonnula ruficapilla, Plate XLVI, fig. 1, Selater, 'Monograph of the Jacamars and Puffbirds.'

While this form may represent *N. ruficapilla*, it appears to differ specifically from that bird, in which the sides of the head and neck are gray.

***Rhopochares cochabambæ*, new species**

SPECIFIC CHARACTERS.—In size and general coloration nearest *Rhopochares ruficapillus* (Vieill.), but back grayish sharply defined from crown, as in *Rhopochares torquatus* (Swains.).

TYPE.—No. 139234, Amer. Mus. Nat. Hist., ♂ ad., Tujima, alt. 8200 ft., Prov. Cochabamba, Bolivia, September 25, 1915; Miller and Boyle.

DESCRIPTION OF MALE.—Crown between auburn and burnt sienna, forming a distinct cap; lores and frontal region (less clearly) buffy; auriculars gray or grayish white; postorbital region and sides of the nape pale smoke-gray, becoming deeper gray on the back and rump, where more or less washed or mixed with cinnamon-rufous; all the tail-feathers, including the central pair, blackish; the central pair more or less margined externally with grayish, in some cases slightly margined or indented with white, usually on the inner web; remaining feathers tipped with white and with white bars on the inner web, not reaching the shaft, the outer feathers usually indented with white on the outer web; wings externally ochraceous tawny, lined with light ochraceous buff; underparts whitish, the throat, ventral region and flanks washed with buffy, the breast barred with black as sharply but less extensively than in *Rhopochares ruficapilla*. Wing, 68–70; tail, 73–75; tarsus, 25–27; culmen, 15–16 mm.

DESCRIPTION OF FEMALE.—Crown cap as in the male, the back averaging more cinnamon-rufous than in the male; tail like the crown, the feathers with paler tips and indistinct blackish bands terminally; underparts much paler than in *R. ruficapilla*, buffy white, without black bars. Wing, 64–69; tail, 67–68; tarsus, 26–28; culmen, 14.5–15.5 mm.

SPECIMENS EXAMINED.—*Rhopochares cochabambæ*. Bolivia: type locality, 7 ♂♂, 7 ♀♀; Valle Grande, 7200 ft., 1 ♀. Argentina: Perico, 4000 ft., Prov. Jujuy, 1 ♂.

Rhopochares ruficapilla. Argentina: Buenos Aires, 2 ♂♂; La Plata, 1 ♀. Uruguay: Concepcion, 1 ♂. Brazil: Rio Grande do Sul, 1 ♂; Ypanema (Natterer), 1 ♂.

This species combines in an interesting way the color characters of *R. ruficapilla* and *R. torquata* and, while evidently representing the former, is, in my opinion, specifically distinct. It ranges at least from the Province of Cochabamba, Bolivia, southward to the Province of Jujuy, Argentina, whence we have a male which, aside from having the black breast-bars somewhat wider, agrees with our topotypical series.

Possibly specimens recorded from Tucuman and Salta¹ as *Thamophilus ruficapillus* should be referred to the species here described.

***Microrhopias emiliæ*, new species**

SPECIFIC CHARACTERS.—Male similar in color to male of *Microrhopias boucardi virgata* but larger, female with the throat and breast chestnut, the belly black.

TYPE.—No. 10775, Museu Goeldi, ♀ ad., May 28, 1914, Alta Mira, Rio Xingu, Brazil; Emilia Snethlage.

DESCRIPTION OF MALE.—Rich velvety black; remiges and rectrices somewhat duller, interscapulars snowy white basally, this color not wholly concealed by their black tips; greater wing-coverts broadly tipped with white, median coverts with rounded white terminal spots, lesser coverts and wing "lining" white; all but median

¹Dabbene, 1910, *Anales Museo Nacional*, Buenos Aires, (3) XI, p. 284.

rectrices with white tips 7-8 mm. in length on outer feathers, decreasing abruptly to 2 mm. on inner pair; feet grayish black; bill black. Wing, 55-56; tail, 52-53; tarsus, 16.5; culmen, 14.5-15 mm. (2 specimens).

DESCRIPTION OF FEMALE.—Similar to the male but slightly duller, particularly on the abdomen, the throat and breast deep, rich chestnut. Wing, 53-54; tail, 51-52; tarsus, 16-17; culmen, 15 mm.

SPECIMENS EXAMINED.—*Microhoppas emiliae*. Brazil: type locality, 1 ♂, 1 ♀; Rio Tocantins, 1 ♂, 1 ♀.

Microhoppas boucardi virgata. Panama, a large series.

Microhoppas boucardi consobrina. Ecuador and Colombia, a large series.

Microhoppas boucardi bicolor. Brazil: Rio Tapajoz, 1 ♂, 1 ♀; Rio Roosevelt, 1 ♂; Porto Velho, 1 ♂, 1 ♀; Baron Melgaco, 2 ♀ ♀.

Microhoppas quiensis. Ecuador, 1 ♀.

It seems unusually appropriate to name this new species, in which the characters are shown only by the female, after its discoverer Dr. Emilia Snethlage, whose energy in the field and zeal in the study have added so greatly to our knowledge of the birds of Amazonia.

***Dryophila devillei subochraceus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Dryophila devillei devillei* Men. and Hellm., but both sexes with entire underparts ochraceous buff, paler on the throat and center of the abdomen, deeper on the breast and flanks; outer margins of inner wing-quills more ochraceous; female with ochraceous streaking of the upperparts and of wing-coverts somewhat deeper.

TYPE.—No. 10777, Museu Goeldi, ♂ ad., November 7, 1914, Rio Curuá (a tributary of the lower Xingu), Brazil; Emilia Snethlage.

SPECIMENS EXAMINED.—*Dryophila devillei subochraceus*. Brazil: type locality, 1 ♂, 1 ♀.

Dryophila devillei devillei. Bolivia: Jatumpampa, 1 ♂ (type of *Dryophila phantatis* Cherrie); Mission San Antonio, Rio Chimoré, 4 ♂ ♂, 3 ♀ ♀.

It is interesting to observe that in this form the male and female are essentially alike below, the former having the breast buff instead of white, as in its allies true *devillei* and *caudata*. The female of *caudata caudata* nearly resembles *subochraceus* in the ground-color of the underparts, but is somewhat paler and slightly yellower. The female of *caudata klagesi*, on the contrary (if our two specimens properly represent it), has the breast white as in the male. In coloration of the underparts *klagesi* closely approaches true *devillei* from which it is distinguished chiefly by the lack of white markings on the sides of the central rectrices.

Dryophila phantatis Cherrie is apparently not separable from *devillei devillei* Men. and Hellm.

***Hypocnemis hypoxantha ochraceiventris*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Hypocnemis hypoxantha hypoxantha* Scl., but somewhat larger, with a larger bill the color throughout browner, the underparts paler yellow, the breast more streaked, the flanks and lower tail-coverts pale ochraceous buff, the abdomen slightly washed with this color; wing-coverts, in the female, tipped with warm buff. Male: wing, 55; tail, 46; tarsus, 20; culmen, 14 mm. Female: wing, 53.5; tail, 44; tarsus, 19.5; culmen, 14 mm.

TYPE.—No. 10788, Museu Goeldi, ♂ ad., May 28, 1914, Alto Mira, Rio Xingu, Brazil; Emilia Snethlage.

SPECIMENS EXAMINED.—*Hypocnemis hypoxantha ochraceiventris*. Brazil: type locality, 1 ♂, 1 ♀.

Hypocnemis hypoxantha hypoxantha. Colombia: La Morelia, 1 ♀. Brazil: Upper Amazon, Pl. XLIII, P. Z. S., 1868, ♂ ad.

Hypocnemis flavescens subflava. Peru: Perené, 1 ♂, 1 ♀; Rio Javara, 1 ♂, 1 ♀; La Pampa, 1 ♂. Bolivia: Todos Santos, 7 ♂♂, 3 ♀♀.

In the coloration of the underparts this species is essentially like *H. f. subflava*. It is, however, separated from that species and from *H. f. flavescens* by its yellow instead of white superciliary and more olive, less striped upperparts.

The form from Bolivia and Peru (*subflava*) is evidently a southern race of *flavescens*, but the specific distinctness of *hypoxantha* is indicated by its occurrence in the heart of the range of *flavescens*.

Hypocnemis collinsi Cherrie proves to be inseparable from *H. f. subflava* Cab.

***Siptornis punensis cuchacanchæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Siptornis punensis punensis* Berl. and Stolz., but upperparts more distinctly streaked; underparts, particularly ventral region and lower tail-coverts paler; rufous markings of wing decidedly lighter; tail longer. Resembling *Siptornis punensis lilloi* Oust., but general tone of the upperparts less rufescent, margins of tertials and greater wing-coverts paler, sayal-brown rather than cinnamon-rufous; rufous band in wing-quills paler and less extensive, particularly on outer quills.

TYPE.—No. 137292, Amer. Mus. Nat. Hist., ♂ ad., Cuchacancha, Bolivia, June 13, 1915; Miller and Boyle.

SPECIMENS EXAMINED.—*Siptornis punensis cuchacanchæ*. Bolivia: type locality, 9 ♂♂ ads., 1 ♀ ad.

Siptornis punensis punensis. Bolivia: Guaqui, 1 ♂ ad., 1 ♀.

Siptornis punensis lilloi. Argentina: Above Tafi del Valle, alt., 9500 ft., 3 ♂♂ ads. (including type of *Siptornis punensis rufala* Chapman), 1 ♀ ad., 4 ♂♂ imm., 2 ♀♀ imm.

Siptornis punensis punensis was described from Puno, Peru, on the northwest shore of Lake Titicaca. It is probable, therefore, that two specimens from Guaqui, distant 115 miles, on the southern shore of the

lake, recently presented to the museum by Lord William Percy, are essentially typical of that form.

They show that specimens from Cuchacancha near Cochabamba, which, in default of topotypical material I had referred to *punensis punensis*,¹ are separable from that race as well as from the Argentine race.

The latter I described as *Siptornis punensis rufala* (*loc. cit.*), but Dr. Hellmayr assures me that this bird is the same as *Siptornis lilloi* Oust., an opinion which may be accepted as authoritative, though as stated in describing *rufala* I am unable to make Oustalet's description conform with our Argentine specimens.

Measurements

	WING	TAIL	CULMEN
Cuchacancha, ² Prov. Coch., Bolivia, ♂	76	94	13.5
Cuchacancha, ² Prov. Coch., Bolivia, ♂	78	97.5	14.5
Cuchacancha, ² Prov. Coch., Bolivia, ♂	73	93.5	14
Cuchacancha, ² Prov. Coch., Bolivia, ♂	75	94	13.5
Guaqui, ³ Bolivia, ♂	78	88	13
Cuchacancha, ² Prov. Coch., Bolivia, ♀	71	89.5	13
Guaqui, ³ Bolivia, ♀	69	87.5	13.3

Cistothorus platensis caracasensis, new subspecies

SUBSPECIFIC CHARACTERS.—Similar in general tone of color to *Cistothorus meridæ* Hellm., but somewhat less rufescent, the crown being uniform in color and olive-brown rather than Prout's brown; differing also in size, proportions and pattern, the tail being longer and equal to the wing, the tarsi and bill shorter, the latter proportionately more decurved; the rump unbarred, the scapulars less striped, the wing-coverts less definitely barred, the bars of the median rectrices broken, the flanks faintly, if at all, barred, the superciliary barely evident. In general pattern of coloration much nearer to *Cistothorus platensis æquatorialis* Lawr., but much less rufescent, the central tail-feathers not regularly barred, the wing, tarsi and bill shorter, the tail nearly as long, and therefore proportionately longer. Male: wing, 44.5; tail, 43.5; tarsus, 16; culmen, 11.5 mm.

TYPE.—No. 150 610, Amer. Mus. Nat. Hist., ♂ ad., Cotiza, Caracas, Venezuela; August 22, 1918; George K. Cherrie.

SPECIMENS EXAMINED.—*Cistothorus platensis caracasensis*. Venezuela: type locality, 2 ♂♂; ? Escorial, near Mérida, 1 ♂.

Cistothorus meridæ. Venezuela: Sierra Nevada, Mérida, alt. 3000 m., 1 ♂; Conejos, near Mérida, 3000 m., 1 ♂.

¹1919, Bull. Amer. Mus. Nat. Hist., p. 329.

²*Siptornis punensis cuchacanchæ*.

³*Siptornis punensis punensis*.

Cistothorus platensis æquatorialis. Ecuador: Pichincha (type locality), 1 ♂; Mt. Chimborazo, 3 ♂♂. Colombia: Valle de las Pappas, Cen. Andes, 1 ♂, 1 ♀; Santa Isabel, Cen. Andes, 3 ♂♂, 5 ♀♀; Chipaque, near Bogotá, 1 ♂; Choachí, near Bogotá, 4.

Cistothorus apolinari. Colombia: Suba Marshes, Bogotá (type locality), 9.

Mr. Cherrie's discovery of a Marsh Wren in a region so well known as the vicinity of Caracas, extends the known range of this group eastward from Mérida (a distance of some 300 miles) and, incidentally, is evidence of his skill and energy as a collector.

The Caracas race is the least rufescent of any of the described forms of the group, and in general tone of coloration closely approaches *Telmatodytes palustris marianæ* (Scott) of the southeastern United States.

I have seen neither *Cistothorus platensis tamæ* Cory, from the Páramo of Tamá, on the Venezuelan-Colombian boundary, nor *Cistothorus æquatorialis fulvescens* Todd, from the Páramo of Guerrero, Santander, Colombia. The first is described as being "more rufous brown," the second as "more rufescent" than *æquatorialis* and presumably, therefore, they both differ more from *caracasensis* than does *æquatorialis*. Todd (1919) makes no mention of Cory's (1916) race and, since both birds are from the same general region and appear to differ from *æquatorialis* in much the same manner, their comparison is to be desired.

The study of our material discloses the interesting fact that, as at Bogotá, two forms of this Wren are found in the Mérida region. The first, described by Hellmayr as *Cistothorus platensis meridæ*, is, in my opinion, unquestionably a distinct species distinguished from *æquatorialis* by its short tail (35 mm.), long hind-toe (19 mm.), pronounced white superciliaries, barred wing-coverts, rump, flanks, etc., as more fully noted in the diagnosis of *caracasensis*. The second, of which we have only one specimen, obviously represents the Caracas race with which it agrees exactly in size and very nearly in color, but has the back more broadly barred with white, the bars on the central tail-feathers complete, as in *æquatorialis*. If these differences are constant they are clearly of subspecific value.

In describing this proposed new race as a subspecies of *platensis*, I merely follow a convention. As a matter of fact, I have no specimens of *platensis* and it is possible that the Andean forms of the *æquatorialis* group may not intergrade with the form of the South Temperate Zone. The known facts in the variation of the Andean races are, however, too contradictory in character to be of predicatory value. Thus, true *æquatorialis* ranges from at least Chimborazo to Bogotá, a distance of

some 600 miles, without exhibiting racial variations; but in passing from the Páramo of Choachí to the Savanna of Bogotá, a distance of 20 miles, we go from the range of *æquatorialis* to that of the specifically distinct, but representative, *C. apolinari*. Furthermore, two forms, which I consider as also specifically distinct, are here shown to inhabit the Mérida region. It is obviously, therefore, not always safe to assume that what we believe to be representative forms are also intergrading races.

Measurements¹

	Wing	Tail	Tarsus	Hind-toe and Claw	Culmen
Chimborazo, ² Ecuador	48	44	20	13	12
Pichincha, ² Ecuador	48	44	18	14	13
Santa Isabel, ² Col.	49	43	20	14	13
Choachi, ² Col.	48	44.5	19.5	14.5	12
Choachi, ² Col.	47	43	20	14	11.5
Caracas, ³ Venezuela	43	41.3	16	12.5	11
Caracas, ³ Venezuela	44.5	43.5	16	13	11.5
Escorial, ³ Venezuela	42	42	16	13	11.5
Sierra Nevada, ⁴ Mérida, Venezuela	47	35.5	19	19	12
Conejos, ⁴ Mérida, Venezuela	46	35	18	19	12

¹A number of the following specimens are not sexed but there appears to be no appreciable sexual difference in size in this group.

²*Cistothorus platensis æquatorialis*.

³*Cistothorus platensis caracasensis*.

⁴*Cistothorus meridae*.

AMERICAN MUSEUM NOVITATES

Number 3

March 9, 1921

59.7.58C(96.9)

A HAWAIIAN RACE OF *CARANGOIDES GYMNO- STETHOIDES*

BY JOHN TREADWELL NICHOLS

The American Museum is in receipt of two specimens of *Carangoides* secured by Dr. B. W. Evermann in the Honolulu market, August 25, 1920, a little over a foot long to base of caudal.

In 'Fishes of the Hawaiian Islands,' 1905, Jordan and Evermann, two closely related species of this genus are recognized as *ferdau* (Forsk.) and *gymnostethoides* Bleeker. Our two specimens are referred to the latter as there described, though they agree exactly with neither one. As a matter of fact, they do not agree exactly with each other. One of them has a longer dorsal lobe (1.8 in depth of body, 2.0 in base of fin) and the ventral surface little paler in color than the dorsal. The other has a shorter dorsal lobe (2.0 in depth, 2.2 in base of fin), the ventral surface pale, and also differs somewhat in outline. This may be a sexual difference.

It further seems not impossible that *ferdau* from the Hawaiian Islands, Jordan and Evermann, is a variation of the same fish. True *ferdau* from the Red Sea and East Indies has appreciably fewer fin-rays.

Leaving out of consideration proportional head and depth measurements which vary with age in this genus, length of the maxillary separates *gymnostethoides* from *orthogrammus* from off the West Coast of North America, the maxillary not reaching below orbit in the former and extending to nearly opposite front of pupil in the latter. In our two specimens the maxillary just reaches the anterior edge of orbit, but it is described for Hawaiian *gymnostethoides* by Jordan and Evermann as reaching opposite front of pupil.

The head of *orthogrammus* is given as $2\frac{3}{4}$, which would be large for a fish with the accompanying depth of $3\frac{2}{3}$, and this may be a good character for that species. Also, in Hawaiian *gymnostethoides* the dorsal lobe is about $\frac{1}{2}$ as high as the depth of body and base of the soft dorsal, this being higher than described for typical East Indian *gymnostethoides* or for *orthogrammus*.

From data which may be gleaned from the literature there seems little more reason for recognizing *orthogammus* as distinct than for recognizing the Hawaiian fish. It is certain that we are dealing with variable and very closely related forms. Perhaps the best plan is to provisionally consider *orthogammus* conspecific with *gymnostethoides* and to separate the same into three races.

The diagnostic characters of the inclusive species are: teeth on the palate and on both jaws, center of chest with a scaleless area, body mostly scaled, lobe of dorsal fin moderately elevated, not much more than half base of fin; slender, depth more than $2\frac{1}{2}$ in length to base of caudal, dorsal soft rays 29–32, anal 25–27, arch of lateral line low, the scutes small, restricted to the posterior portion of the straight part, 25 more or less. The three races would be differentiated as follows.

1. Lobe of soft dorsal about $\frac{1}{2}$ depth of body and base of fin. Naked area on chest narrow.....*C. g. evermanni*, new subsp. Honolulu.
Lobe of soft dorsal considerably less than $\frac{1}{2}$ depth of body or else base of fin....2.
2. Maxillary not reaching below orbit.....*C. g. gymnostethoides* Bleeker. Batavia.
Maxillary to nearly opposite front of pupil. Scutes about 17.
C. g. orthogammus (Jordan and Gilbert). Clarion Id.

***Carangoides gymnostethoides evermanni*, new subspecies**

The type, No. 7432, American Museum of Natural History, Honolulu market, August 25, 1920, B. W. Evermann, is 313 mm. long to base of caudal. Depth, 2.7 in this measure; head, 3.5. Eye, 5.2 in head; maxillary, 2.6; dorsal lobe, 1.4; anal lobe, 1.7; pectoral, 1.0 (right side) to 0.8 (left side). Maxillary to under front of orbit, not reaching pupil. Gill-rakers 21 on lower limb of first arch. Height of anterior lobe of soft dorsal 2.0 in base of that fin (not following curve of back), 1.8 in depth of body. Dorsal soft rays 30, anal 26. Chest before the ventrals narrowly naked. Color in alcohol dirty purplish gray, scarcely paler on the belly; fins, except pectoral which is paler, more or less dusky; dorsal, anal, and caudal lobes blackish.

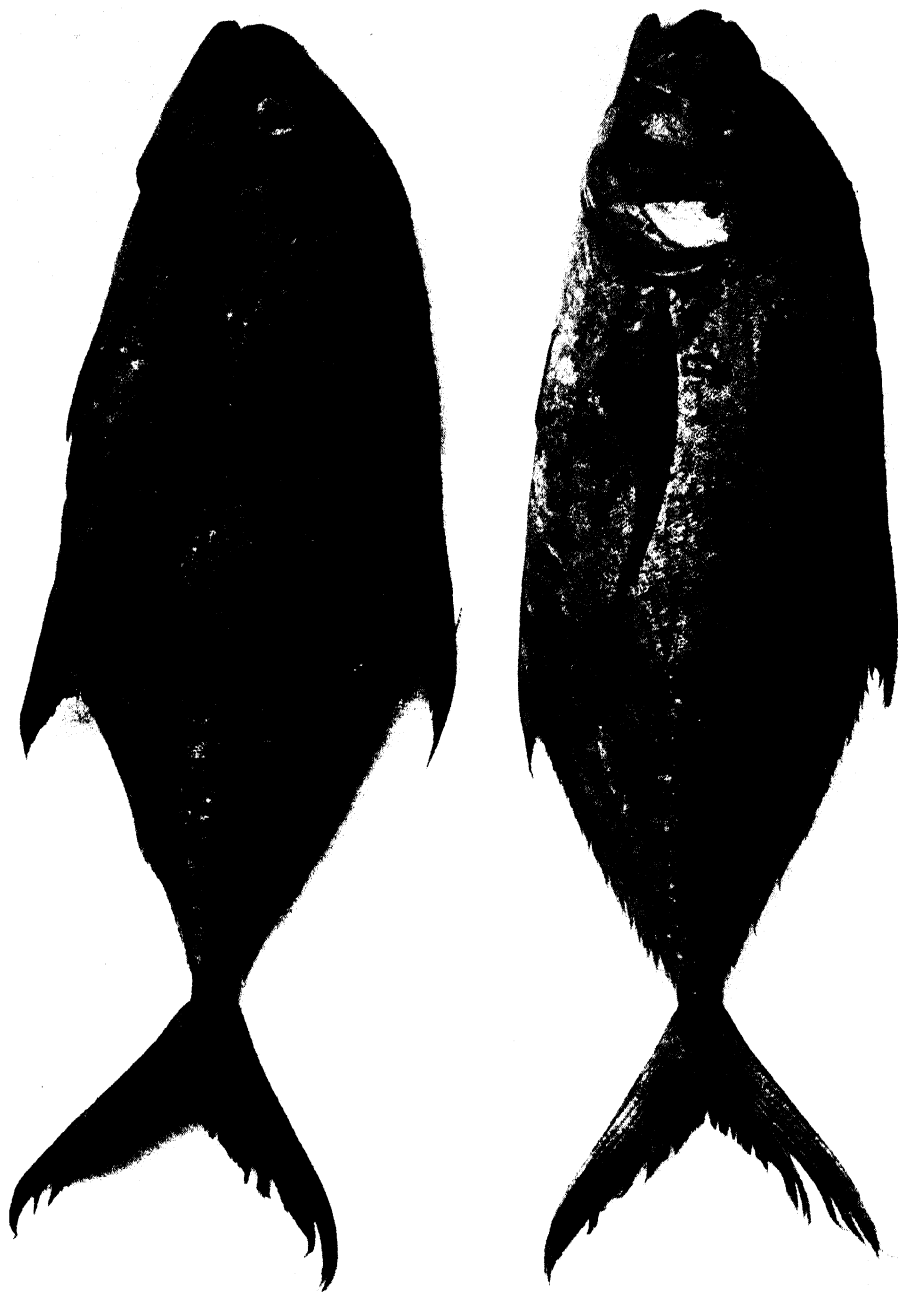


Fig 1. *Carangoides gymnosteloides evermanni*, new subspecies.
Type (left) and cotype (right).

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59.81,15:14.71

THE BONY STRUCTURE AND PHYLETIC RELATIONS OF *SPHÆRODACTYLUS* AND ALLIED LACERTILIAN GENERA, WITH THE DESCRIPTION OF A NEW GENUS

By G. K. NOBLE

Sphærodactylus embraces a group of very small neotropical lizards including one species which is probably the smallest lizard in the world. It is not surprising that the osteology and closest affinities of the genus have remained until this time practically unknown. It is not my intention to give here more than a bare outline of the more important structural features of *Sphærodactylus* or to discuss points which do not add definite evidence of phyletic relations.

The various species of *Sphærodactylus* have been exhaustively studied by Dr. Thomas Barbour. He has ready for press an elaborate monograph on the group. Dr. Barbour has aided me greatly in my study of the osteology of *Sphærodactylus* and its allies. I am especially indebted to him for specimens of *Aristelliger*, *Phelsuma*, *Lathrogecko*, *Lepidoblepharis*, and *Gonatodes*. These specimens were received in exchange from the Museum of Comparative Zoology and are now incorporated in the collections of the American Museum.

COMPARISON OF STRUCTURAL CHARACTERS

Sphærodactylus possesses procœlous vertebræ. It would seem that it could no longer be ranged with the gekkonids but should be grouped with *Coleonyx* in the Eublepharidæ. A detailed study of the skeleton of *Sphærodactylus* has shown that it is not closely related to *Coleonyx*. A search for its nearest allies has involved the examination of the skeletons of many genera of gekkonids and eublepharids. Small differences have been observed in the material prepared. It has been difficult to determine the relative value of these differences. Those characters which have seemed the most important are discussed below.

Vertebræ and Ribs

The vertebræ of *Sphærodactylus* are procœlous, agreeing in detail with those of the eublepharids *Lepidoblepharis* and *Lathrogecko*, and but slightly different from those of *Coleonyx*. Two views of a single vertebra

of *Sphærodactylus* are shown in Figure 1. It will be noted that the vertebra is of a very simple type.

It was surprising to find that a cartilaginous or fibro-cartilaginous band extends in *Sphærodactylus* from about the middle of the neural arch to the angular portion of the head of the rib. The cartilaginous nature of this band and its position relative to the neural arch and rib strongly suggest that it is the last vestige of the tubercle, a character-



Fig. 1.—Vertebra (18th) of *Sphærodactylus macrolepis* Günther, lateral and posterior aspect. The former shows the cartilaginous tuberculum (stippled) of the rib.

istic structure of the ribs of primitive reptiles but one believed to have been entirely lost in the Lacertilia. Williston (1914, p. 33) states: "By the loss of the tubercle in lizards, the head became truly single-headed, and attached solely to the body; and this condition is characteristic of the order Squamata."

A cartilaginous tubercle, if such it may be called, is found not only in *Sphærodactylus* but also in *Lathrogecko*, *Lepidoblepharis*, and the neotropical species of *Gonatodes*. In *Coleonyx*, it is reduced, is more fibrous, and has a more anterior position than in *Sphærodactylus*. In all other lizards which I have examined, gekkonids, iguanids, teiids, xantusids, etc., this structure is represented by a ligament which is sometimes very slender and attached to the body of the vertebra near the articulation of the capitulum. In most iguanids and gekkonids, it is flattened and sometimes very difficult to distinguish.

Skull Structure

In addition to the procœlous form of the vertebræ, one other character has been used to distinguish the Eublepharidæ from the Gekkonidæ. The parietals of the eublepharids are stated to be fused into a single element in contrast to the paired parietals of the latter group. The parietals of *Sphærodactylus* remain perfectly distinct throughout life. It would seem that this was a feature indicating a close affinity to the true gekkonids. An examination of the skulls of the various gekkonids and eublepharids at hand has convinced me that the fusion of the parietals into a single element cannot be considered diagnostic of the eublepharids. Most gekkonids possess paired parietals, but there are exceptions even within a genus. Thus, I find that while all the neotropical species of *Phyllodactylus* at hand have paired parietals, there is but a single element in *P. siamensis*. The single parietal is not a constant feature of all eublepharids. It is single in *Coleonyx variegatus* (Baird) and *C. elegans* Gray, but double in *Lathrogecko xanthostigma* Noble. It was described as single in *Lepidoblepharis festæ* Peracca but it is double in *Lepidoblepharis barbouri* Noble.

Cope (1892) pointed out some differences between the skull of *Coleonyx* and that of *Phyllodactylus*. I have compared skulls of the same genera but have failed to find any marked differences. There is a reduced jugal in *Coleonyx* as well as in *Phyllodactylus*. Cope, however, did not consider those differences which he found of great importance, since in a later report (1898, p. 464) he states that the skeleton of the Eublepharidæ "is similar" to that of the Gekkonidæ "except in the procœlian vertebræ and single parietal bone."

Hyoid and Branchial Arches

Perhaps no one structure indicates the relationships of *Sphærodactylus* better than its hyoid apparatus. As shown in Figure 2A, the arches are very complete. The second epibranchial is well developed and is attached at both ends, a very unusual condition. The distal end is adherent to the exoccipital at the base of the paroccipital process; the proximal end is loosely attached to the second basibranchial some distance from the end. The hyoid arch is a simple bent rod. It is attached distally to the paroccipital process. The hyoid apparatus of a number of gekkonids has been figured. I have examined specimens of *Phyllodactylus* (3 species), *Thecadactylus*, *Hemidactylus*, *Aristelliger*, *Gehyra*, *Lygodactylus*, *Gekko*, *Tarentola* (2 species), *Pachydactylus*,

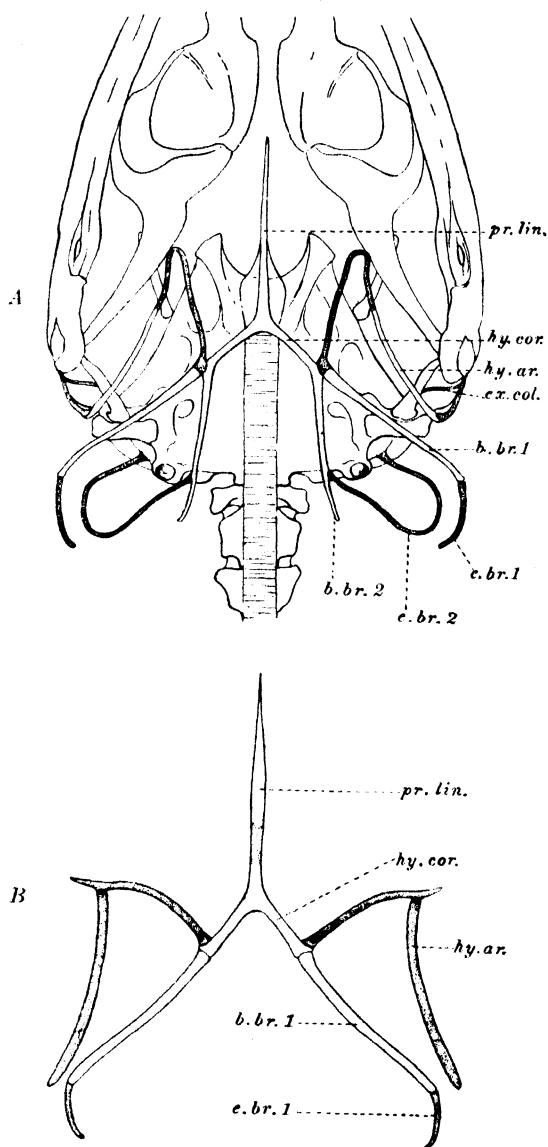


Fig. 2.—Hyoid Apparatus, ventral view. A.—*Sphaerodactylus macrolepis* Günther, *in situ* to show attachments. B.—*Paragonatodes dickersoni* (Schmidt), a typical gekkonid hyoid apparatus with a specialized hyoid arch and with the second branchial arch wanting.

B. br. 1 = basibranchial I; b. br. 2 = basibranchial II; e. br. 1 = epibranchial I; e. br. 2 = epibranchial II; ex. col. = extracolumella; hy. ar. = hyoid arch; hy. cor. = body of hyoid; pr. lin. = lingual process.

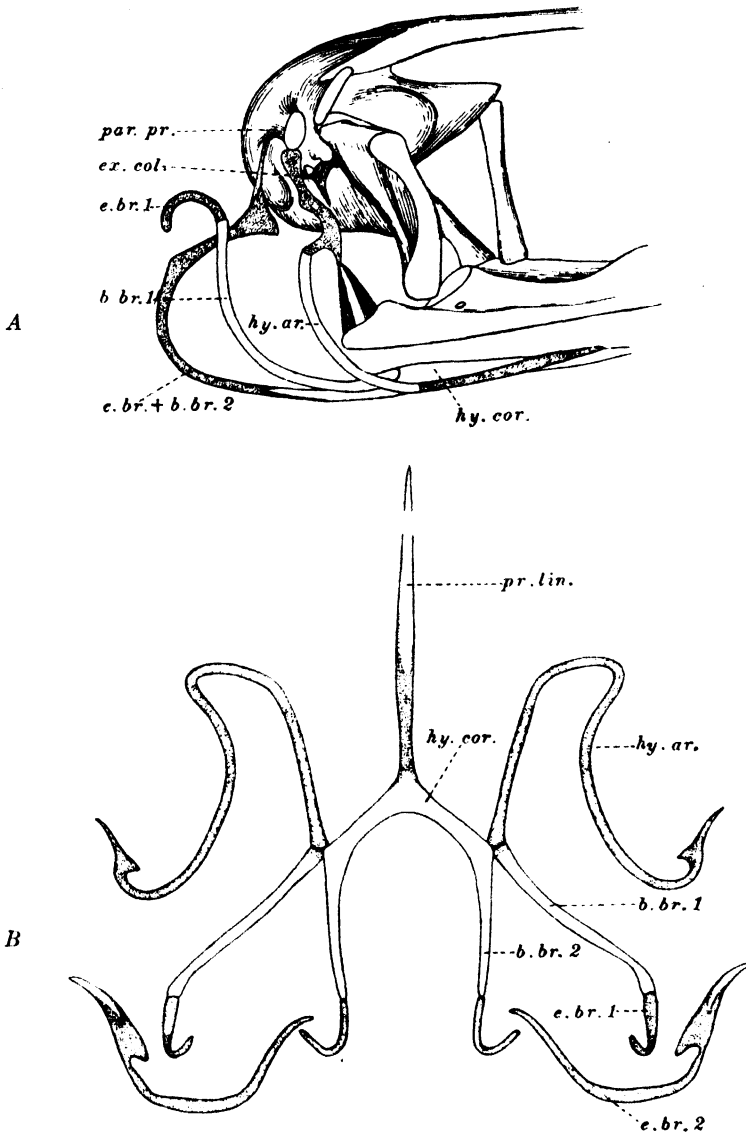


Fig. 3.—Hyoid Apparatus. A.—*Coleonyx variegatus* (Baird), lateral aspect of posterior part of cranium showing attachments of hyoid apparatus to skull. B.—*Lathrogecko xanthostigma* Noble, ventral view of the hyoid and branchial arches in their normal position.

B.br. 1 = basibranchial I; b.br. 2 = basibranchial II; e.br. 1 = epibranchial I; e.br. 2 = epibranchial II; ex.col. = extracolumella; hy.ar. = hyoid arch; hy.cor. = body of hyoid; par.pr. = paroccipital process; pr.lin. = lingual process.

Phelsuma, and *Gonatodes* (3 species). In none of these genera, except the neotropical species of *Gonatodes*, do the hyoid and branchial arches have a form and arrangement approaching the condition in *Sphærodactylus*. The arches of all gekkonids, with the exception just noted, are more or less reduced, especially the second branchial arch. The second epibranchial is generally present as a short and delicate cartilage lying free in the muscles and considerably removed from any attachment to either skull or basibranchials. In a number of specimens I could find no indication of such an epibranchial. It may not exist in the African gekkonid described by Schmidt as *Gonatodes dickersoni* (Figure 2B).

In the South American *Gonatodes atricucularis* Noble and *G. annularis* Boulenger, the hyoid is very similar to that of *Sphærodactylus*. The chief difference lies in the fact that the second epibranchial, although well developed, is loosely associated with the skull and is free from the basibranchial. These two species agree with *Sphærodactylus* in the long basibranchials, extensive epibranchials, and simple hyoid arch. No gekkonids, except the neotropical species of *Gonatodes*, have been found to agree with *Sphærodactylus* in possessing a combination of these three features.

It is remarkable that such a distinctive type of hyoid apparatus as that of the neotropical species of *Gonatodes* should be found in the eublepharids *Lathrogecko* and *Lepidoblepharis*. The arches of these two genera are identical and differ from that of *Gonatodes atricucularis* only in the slightly shorter first branchial arch and slightly larger arrow head to the second epibranchial. The distal end of the second epibranchial is not calcified in *G. atricucularis* as it is in the several specimens of *Lepidoblepharis barbouri* and a specimen of *Lathrogecko xanthostigma* (Figure 3B) which I have examined. In all three forms, the distal end of the second epibranchial is loosely attached to the paroccipital process and lies closely associated with the endolymphatic sac. It seems obvious that the presence of such a well-developed hyoid in *Sphærodactylus*, *Lepidoblepharis*, *Lathrogecko*, and the neotropical forms of *Gonatodes* indicates common ancestry.

The most primitive type of lacertilian hyoid apparatus is that found in *Coleonyx*. This was not realized until very recently (Fürbringer, 1919). The figure of Cope (1892, Pl. III, fig. 8) of the hyoid apparatus of *C. variegatus* is very incorrect. *C. variegatus* and *C. elegans* have similar hyoid and branchial arches. The second epibranchial is continuous with the second basibranchial and there is no suture or break between the two parts. The distal portion of this second branchial arch is attached very

loosely to the skull by a ligament. The cartilaginous portions of both hyoid and branchial arches have a characteristic form (Figure 3A). This very primitive type of hyoid apparatus found in *Coleonyx* seems to indicate that the genus has no close affinity to *Sphærodactylus*. If primary importance were arbitrarily laid on the form of the hyoid and branchial arches in determining relationships, it would follow that *Sphærodactylus* is more closely related to the gekkonid *Gonatodes* than to the eublepharid *Coleonyx*. Such is probably the correct view.

Pectoral Girdle

Sphærodactylus possesses a typical gekkonid shoulder girdle, with suberuciform interclavicle and expanded, perforated clavicle. Its pectoral girdle differs radically from that of *Coleonyx* in having four instead of three ribs attached to the sternum. The other two genera of neotropical eublepharids agree with *Sphærodactylus* as regards the sternal ribs but differ in the form of the clavicle. In neither *Lepidoblepharis* nor *Lathrogecko* is the clavicle perforated.

Altogether too much emphasis has been laid on form of the clavicle as defining the larger groups of Lacertilia. It is now well known that a number of iguanids possess expanded and perforated clavicles. The expanded, perforated clavicle cannot be considered a diagnostic feature of all gekkonids. The clavicle of the neotropical species of *Gonatodes* (Figure 4A) is not more expanded than many so-called cylindrical clavicles.

If one considers the slightly dilated clavicle of the neotropical species of *Gonatodes* (Figure 4A) as the primitive type, one can readily derive from that the conditions found in the neotropical eublepharids. The clavicle of *Lathrogecko* is slightly more dilated than that of *Gonatodes*. In *Lepidoblepharis* (Figure 5A) it is still more expanded. In *Sphærodactylus* (Figure 5B), the expanded portion has become fenestrated. The series exhibited by *Gonatodes*, *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* illustrates beautifully how the clavicle might have been gradually expanded and in the extreme stage thinned out until a foramen was formed. There is much reason to believe that we have in this series of genera a natural group and that the expanded, perforated clavicle has been evolved from the cylindrical one.

It may be well to mention at this point that the suberuciform interclavicle is not always present in the gekkonids. I have found that the African *Gonatodes dickersoni* and the Madagascanian *Phelsuma laticauda*

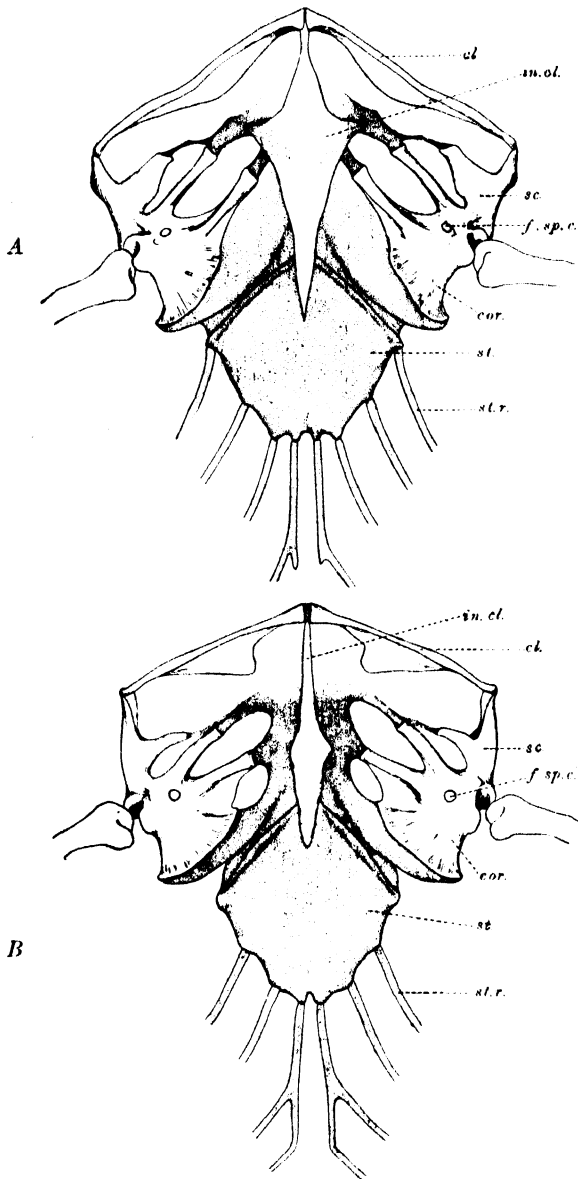


Fig. 4.—Pectoral Girdles, ventral aspect. A.—*Gonatodes atricucullaris* Noble. B.—*Paragonatodes dickersoni* (Schmidt).

Cor. = coracoid; cl. = clavicle; f.sp.c. = supracoracoid foramen; in.cl. = interclavicle; sc. = scapula; st. = sternum; st.r. = sternal rib.

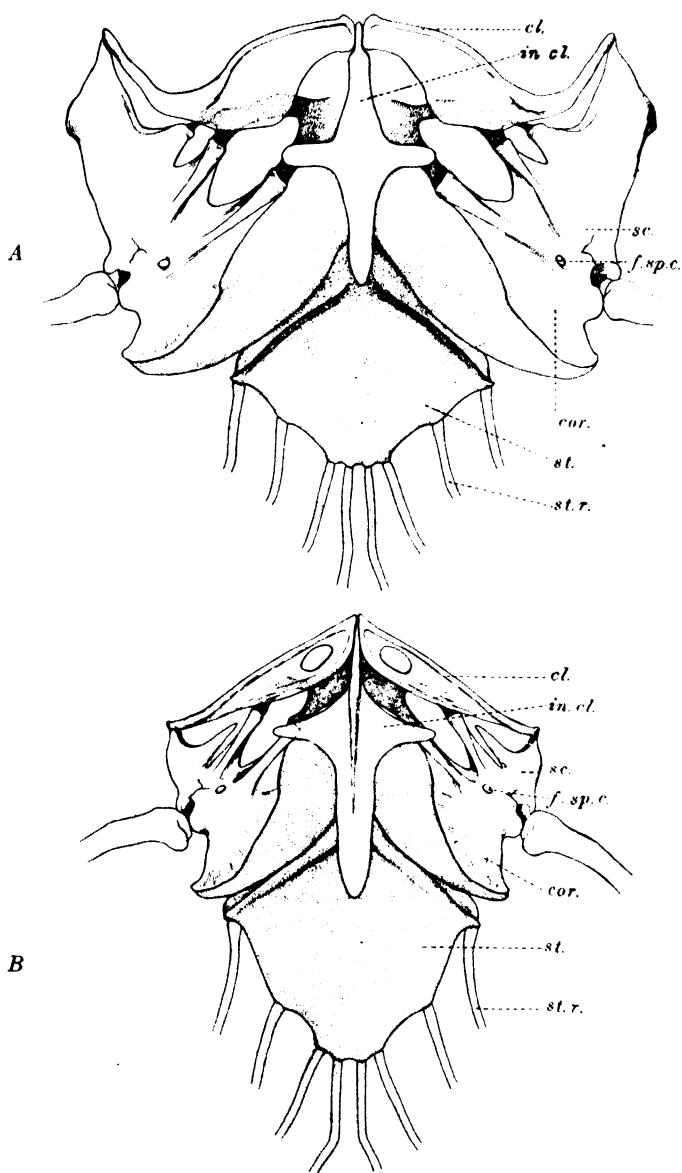


Fig. 5.—Pectoral Girdles, ventral aspect. A.—*Lepidoblepharis barbouri* Noble. B.—*Sphaerodactylus macrolepis* Günther.

Cor. = coracoid; cl. = clavicle; f.sp.c. = supracoracoid foramen; in.cl. = interclavicle; sc. = scapula; st. = sternum; st.r. = sternal rib.

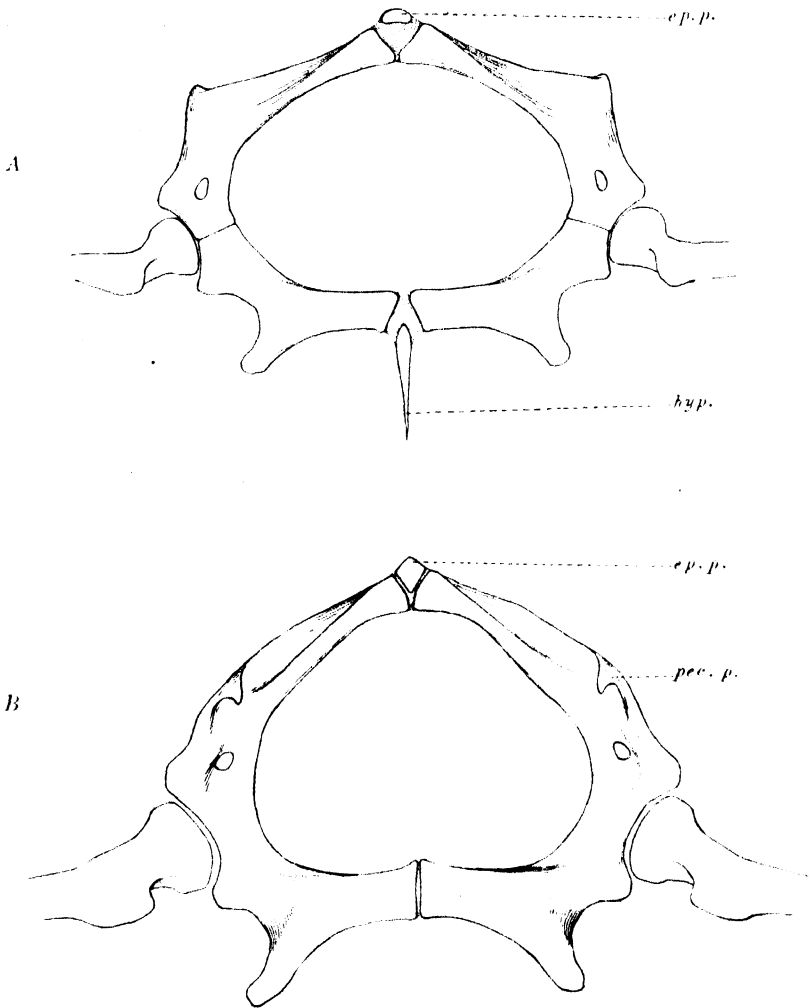


Fig. 6.—Pelves, ventral view. A.—*Paragonatodes dickersoni* (Schmidt.) B.—*Sphaerodactylus macrolepis* Günther.

Ep.p. = epipubis; hyp. = hypo-ischium; pec.p = pectineal process.

have the transverse arms of the interclavicle reduced or wanting. The former species differs greatly from the neotropical species of *Gonatodes* in having only three sternal ribs (Figure 4B).

Pelvis and Cloacal Bones

Gonatodes dickersoni differs from the neotropical species of *Gonatodes* in the form of its pelvis (Figure 6A) and the presence of cloacal bones in the male. The pubis has a very small pectineal process in *G. dickersoni* and there is a well-developed hypo-ischium and epipubis. The pubis of the neotropical species of *Gonatodes* agrees with that of *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* in the large pectineal process directed ventrally. The hypo-ischium may be very rudimen-

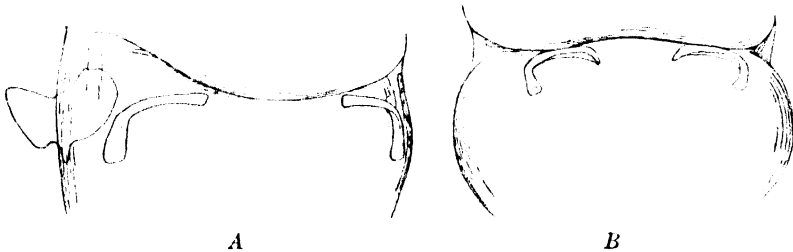


Fig. 7.—Cloacal Bones, showing relation to the cloacal slit. A.—*Coleonyx variegatus* (Baird). B.—*Paragonatodes dickersoni* (Schmidt).

tary or wanting in *Sphærodactylus* (Figure 6B) and is wanting in the other genera. In *Coleonyx* there is no hypo-ischium, but there are two pairs of large cloacal bones (Figure 7A), one pair projecting through the skin.

Very little reference appears in the literature in regard to the cloacal bones. Lying free near the hemipenes and below the skin, they have been often overlooked. The hypo-ischium has been often called an os cloacæ. The hypo-ischium and cloacal bones should not be confused. They are neither homologous nor analogous. I find the greatest development of cloacal bones in *Pachydactylus maculatus* where, in addition to a broad fenestrated median bone lying transversely across the anterior lip of the cloaca, there is a pair of irregularly shaped bones posterior to either corner of the cloacal slit. The hypo-ischium in this species is very long. In the several species of *Phyllodactylus* which I have examined, the males are provided with cloacal bones very similar in form to those of *Gonatodes dickersoni*.

External Characters

The obvious external similarity of *Gonatodes* and *Lepidoblepharis* has been pointed out by Peracca (1897). Of the three features emphasized by Ruthven (1916) in distinguishing *Lathrogecko* from *Lepidoblepharis*, only one, that of the form of the digits, can be considered of generic importance. It is apparent from a study of both internal and external structure that *Lathrogecko* is closely allied to *Lepidoblepharis*. *Sphærodactylus* agrees with *Gonatodes*, *Lathrogecko*, and *Lepidoblepharis* in the slender form of the body, the narrowness of the head, the arrangement of labials, rostral, and nostril, and the shape of the pupil. Some species of *Sphærodactylus* agree with some species of *Gonatodes* in the pronounced sexual dimorphism and general color pattern. Still, it has been very difficult to pick out any definite external characters which demonstrate a closer relation between *Sphærodactylus* and the above genera than between *Sphærodactylus* and any other gekkonoid groups. Cope (1898) seemed prepared to believe that *Sphærodactylus* was closely allied to *Phyllodactylus*. Most other reviewers have considered that the form of the digit tips in *Sphærodactylus* warranted the placing of that genus in an isolated position in any scheme of phylogeny adopted.

A careful examination of the digits of *Sphærodactylus* will show that their terminal dilations are composed of scales having the same mutual relations as those which make up the claw sheath in *Lepidoblepharis*. It would seem that an asymmetrical enlargement of one side of the claw sheath of *Lepidoblepharis* would give exactly the condition found in *Sphærodactylus*. In *S. macrolepis* and apparently throughout the genus, this enlargement has been the outer scales of the claw sheath in the pes and the outer on all the digits of the manus except the fifth, where it has been the inner side of the original sheath which has become enlarged to form the disk.

The homology of these scales becomes much more obvious if the claw sheaths of *Gonatodes* and *Lathrogecko* are compared at the same time. It seems fairly certain when these sheaths are arranged in a series that we have before us an actual phylogenetic sequence. The claw sheath of *Lathrogecko* (Figure 8B) may have been derived directly from that of the neotropical species of *Gonatodes* by an enlargement of the terminal scales of the digits. The claw sheath of *Lepidoblepharis* (Figure 8C) could have been developed from the sheath of *Lathrogecko* by the dropping out of the second median scale. Finally, the disks of *Sphærodactylus* are understandable only if we assume that they were formed from the *Lepidoblepharis* claw sheath by the asymmetrical enlargement of the

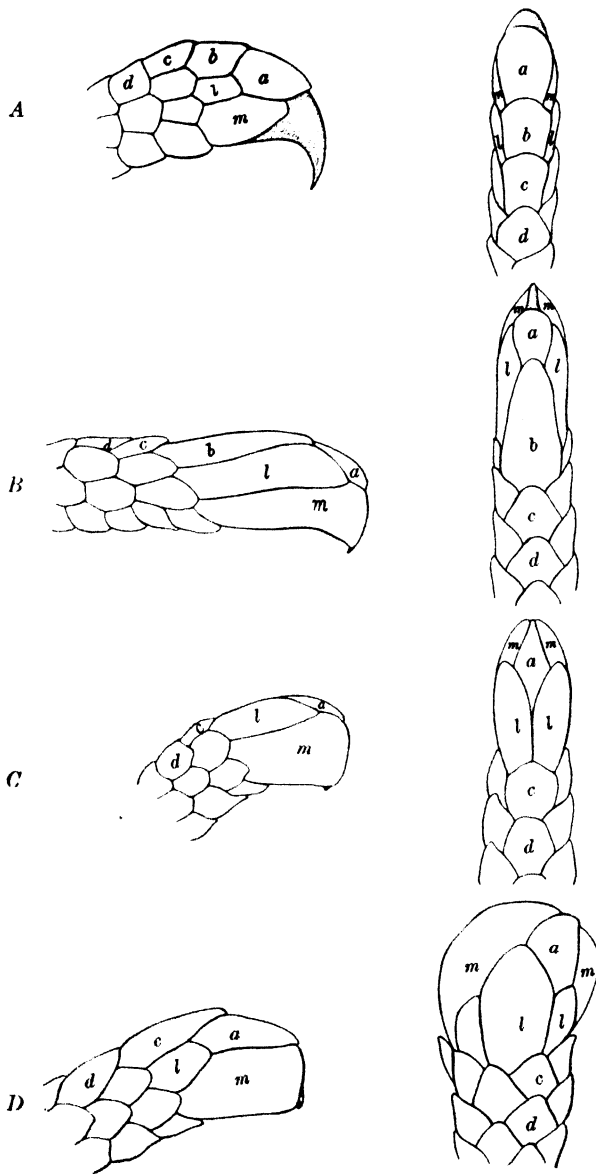


Fig. 8.—Claw Sheaths illustrating four stages in a single line of specialization. Homologous scales bear the same letters; original dorsal scales, *a-d*; laterals, *l* and *m*. A.—*Gonatodes atricucularis* Noble. B.—*Lathrogecko ranthostigma* Noble. C.—*Lepidoblepharis barbouri* Noble. D.—*Sphærodactylus macrolepis* Günther.

scales on one side of the sheath. The steps assumed in the change from the *Gonatodes* to the *Lathrogecko* to the *Lepidoblepharis* types of sheath are not great; the step from the *Lepidoblepharis* to the *Sphærodactylus* type is less clear but no less admissible.

PHYLOGENETIC RELATIONS

It follows from the above résumé of distinctive characters that the eublepharids, *Sphærodactylus*, *Lepidoblepharis*, and *Lathrogecko*, are closely related to each other and to the neotropical species of the gekkonid *Gonatodes*. At least one of the Old World species of *Gonatodes*, and probably all, has no close affinity to the neotropical forms. Since the genus *Gonatodes* was based on a neotropical species, a new name will have to be proposed for Old World forms, or for at least the one species which we have studied in detail. It is probable that this new genus will embrace all three African species, less probable that it will include the East Indian forms which have until now been referred to *Gonatodes*.

PARAGONATODES, new genus (Gekkonidæ)

TYPE.—*Gonatodes dickersoni* Schmidt. (Type locality, Medje, Belgian Congo.)

DIAGNOSIS.—Digits slender, clawed; the distal portion of the digits slightly compressed and forming an angle with the claw; these distal portions covered beneath with a single series of scales distally, and with a double series of much smaller ones proximally (see Schmidt, 1919, fig. 6); body slender, with granules and tubercles above, with small scales below; tail cylindrical; pupil circular; eyelid distinct around eye. Hyoid apparatus reduced; no second basibranchials; no second epibranchials (Figure 2*B*); interclavicle dagger-form, no transverse arms; clavicle dilated but not fenestrated (Figure 4*B*); only three sternal ribs; pectineal process of pubis rudimentary; a well-developed hypo-ischium; male with a single pair of bow-shaped cloacal bones (Figure 7*B*); ligamentous tubercle of the ribs much reduced and proximated to the capitulum.

It seems extremely probable that *Sphærodactylus*, *Lepidoblepharis*, and *Lathrogecko*, with their procœlous vertebræ, four sternal ribs, cartilaginous tuberculum, distinctive hyoid, pelvis and cloacal regions, form a natural group of genera. These genera show closer affinity to *Gonatodes* than to any other gekkonid.

Evidence has been brought forth to show that we have in this group a natural series commencing with *Gonatodes*, and leading through *Lathrogecko* and *Lepidoblepharis* to *Sphærodactylus*. It is believed that this series represents an actual morphogenetic sequence. The more important changes which occurred in this series may be listed. (1) The vertebræ

changed from amphicœlous to procœlous, and most of the intercentra were lost. (2) The second epibranchial lost its characteristic arrow-shaped head and became attached to the exoccipital near the base of the paroccipital process. The proximal end of the second epibranchial migrated anteriorly and became loosely attached to the second basi-branchial. (3) The clavicles evolved from narrow but flattened rods to broadly expanded sheets, and finally thinned out in their proximal portions to form median fenestræ. (4) The terminal scales of the digits became elongated to form six-scaled claw sheaths. The posterior dorsal of these six scales dropped out to form five-scaled sheaths. Finally, there was an asymmetrical enlargement of one side of the sheaths to form disks.

It is important to emphasize that this series of steps has only been assumed after a study of all the genera of gekkonids and eublepharids available to me; that *Gonatodes*, *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* have more in common with each other than can be found between *Sphærodactylus* and *Coleonyx*, or *Gonatodes* and any of the ten other genera of gekkonids at hand. In other words, it seems extremely likely that, among other things, the procœlous vertebræ have been developed in this series quite independently of similar changes in any other series. It follows that in all probability the Eublepharidæ had a polyphyletic origin and, instead of being a very ancient group as hitherto believed, they may be a very recent assemblage, even if a conservative one.

It has been suggested that the gekkonids are degenerate forms, their amphicœlous vertebræ secondary structures. There is obviously nothing primitive in the highly reduced skull of the gekkonids. *Coleonyx* with its very primitive hyoid possesses procœlous vertebræ. Xantusids with procœlus vertebræ also have primitive hyoids, and I have found that *Xantusia vigilis* retains the intermedium in the carpus as further evidence of its ancestral position among primitive Lacertilia. Why, then, should we not reverse our series and evolve *Gonatodes* from *Sphærodactylus* or at least *Lathrogecko*? This would necessitate developing intercentra again, evolving cylindrical from expanded clavicles, and changing from specialized to primitive claw sheaths. Altogether too little is known about the osteology of the Lacertilia to be entirely certain about the direction in which evolution has progressed. The view I have outlined above seems at the present time the most probable.

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GEOGRAPHIC AVERAGE, A SUGGESTED METHOD FOR THE STUDY OF DISTRIBUTION

BY FRANK E. LUTZ

Students of the distribution of animals and plants have divided North America, especially United States, into sections, within each of which the fauna or flora, or both, is believed to be more or less homogeneous and more or less distinct from other, corresponding sections. I must confess that these sections seem to me less distinct than they once did. It is a characteristic of human psychology that we classify and make categories where there are no definite classes or categories. We speak of north, east, south, and west. When we go more deeply into the subject we speak of northeast, southeast, and so on. At sea, however, we box the compass by such gradual steps that we have a continuous circle with no separate divisions. This does not mean that "north," "east," and so on are not convenient and useful conventions but, as a matter of fact, they are only very general terms. In the same way, there is no definite "arctic-alpine," "austral," and so on, and a definiteness can only be maintained for these zones by a special selection of "indicator species" or something of that sort. If this procedure be accepted, almost any sort of system of zones may be devised by selecting appropriate "indicators."

On the other hand, some system is convenient and useful. The carefully investigated system of Merriam, based on the fundamental studies of Allen, has been widely accepted. Can we take the proposed biotic areas and get some concrete expression for them that will be based on the biota as a whole? This expression should, if possible, be something that will help us to say with a fair degree of assurance that a given limited area or a given species belongs in this section or that. After trying a number of different methods of getting such an expression, it seems to me that what I am calling the "geographic average" gives the best promise.

Partly because plants are a large determining factor in the distribution of animals and partly because it was convenient to use the data given in Britton and Brown's 'Illustrated Flora of the Northern States and Canada,' the illustrations given here are based on data secured from the second volume of that work, Portulacacæ to Papilionacæ, inclusive. There was no reason for taking this portion of the flora rather than some

other; I merely wanted a random sample. The only species intentionally omitted from this lot were those that were said to have been introduced by man and a few in which the distributional range was not clear to me.

The limits of the range of a species outline a polygon. If we are given the latitude and longitude of these limits we can average them and get the latitude and longitude of a point which is approximately in the center of the range of a species.¹ This would be the geographic average of that species, and it would indicate rather clearly whether the species tends to be northern or southern, eastern or western. Having calculated the geographic averages of each of an aggregate of species (those in a particular sphagnum bog, or at a given altitude on a certain mountain, or in a given political division, or what not) one could average these species averages and get a geographic average for the aggregate under consideration.

In Britton and Brown's 'Flora' the range of each species is stated by giving the names of the states or other political divisions to which the species extends. I took the approximate center of each of these political divisions as the limit of the range in that direction and calculated geographic averages for each species. On the basis of the 77 of these that occur in Labrador, I found that the geographic average in North America, including Greenland,² of the Labrador flora is at about 51° N., 89° W., with an average range in latitude of about 20° and in longitude of about 79°. If the complete flora were considered, this average might be somewhat different but, as a first approximation, it indicates that, in North America, the flora of Labrador is one that centers a little south of Hudson Bay and, on the average, extends southward to about the latitude (41° N.) of southern New York or northern Colorado and westward to about 130° W., say British Columbia.

Britton and Brown's 'Flora' concerns itself only with northeastern North America. Taking up several areas along the northern Atlantic slope and basing the averages on species of plants from Portulacacæ to Papilionacæ, inclusive, we get the following.

¹If the range were crescentic in shape, the geographic average might be a point between the horns of the crescent, where the species does not, in fact, exist.

²I did not use limits in Asia or Europe in calculating these averages; they were not given definitely and did not seem important for what I had in mind. Of the 91 North American species which occur in Palearctica and for which I have calculated the geographic averages, 12 that occur in Asia but not in Europe have a geographic average of 48° N. (Range, 22°), 95° W. (Range, 79°), and 14 that occur in Europe but not Asia have a geographic average of 49° N. (Range, 13°), 78° W. (Range, 42°). The numbers on which these averages are based are too small to be entirely significant and they are based only on species of northeastern North America. A study based on fuller data is being prepared.

	Geographic Average		Average Range	
	Latitude	Longitude	Latitude	Longitude
Labrador	51°	89°	20°	79°
Newfoundland	48	87	20	70
Nova Scotia and New Brunswick	45	87	19	56
New England	42	85	17	44
Md., Va., and Del.	39	85	14	26

It is clear, as would be expected, that the average latitude decreases as we take more southern areas but it might not have been so certainly anticipated that the longitude would also decrease, that is, that the geographic average of the areas would steadily move eastward although the areas in question are more and more western. This seems to be bound up with the further fact that the average longitudinal range¹ decreases steadily and markedly as we pass from north to south. The similar decrease in the average latitudinal range, while not so great, is more surprising, as one might have expected that Labrador species, being restricted by extreme arctic conditions from spreading in a northward direction would have a less average north-and-south range than those in Virginia, for example, which have a great distance, both north and south, to which they can spread.

It is true that a study of the average ranges of 386 species of plants native to northeastern North America shows that there is a close positive correlation between the extents of latitudinal and longitudinal ranges but I do not think that this, coupled with the relatively wide longitudinal range of northern species,² is a full explanation of the wide latitudinal range of such species. Perhaps the explanation is that a species which is able to survive difficult northern conditions finds it easy to live in a relatively wide range of other conditions, while the same is not true of the more southern species.

Labrador is in what was called the Barren-Ground Fauna of the Arctic Realm by Allen and the Arctic Zone of the Boreal Region by Merriam. There is little or nothing from farther north which might

¹Longitudinal range as measured by degrees of longitude. It should be remembered that a degree of longitude is not as many miles in higher latitudes as in more equatorial ones. However, this difference is not great enough between Virginia and Labrador to negative the indication that, among these plants of northeastern North America, the more northern ones tend to have a wider east-and-west distribution than the more southern ones.

²Not only is the average longitudinal range in North America of the Labrador species considered here 79°, as compared with 26° for those in Virginia, but other data on the Labrador flora as a whole show that 72% of the Labrador flora occur also in Palearctica.

have extended out of its "regular" range into Labrador, but it is conceivable that really southern things got into unusually favorable, ecologically speaking, situations in Labrador and were able to survive there, at least long enough to be collected and recorded by the botanists. These latter plants, classed as Hudsonian, would, for the most part, have a range along eastern North America southward from Labrador. The material from Labrador can be analyzed as follows.

	Average Latitude	Average Longitude
(A) 40 species that do not occur far directly southward	54°	90°
(B) 37 species that occur directly southward	49	85

The number of species is small for the purpose of computing averages and the grouping is admittedly rough but, as an illustration of method and until we have something better, we can take the geographic average for A as that of the Arctic¹ and the one for B as that of the Hudsonian.

Newfoundland is considered by Allen to be partly in the Cold Temperate Subregion and partly in the Arctic Realm. Merriam divides it between the Arctic, Hudsonian, and Canadian Zones of the Boreal Region.² The present material may be analyzed as follows.

	Average Latitude	Average Longitude
(C) 57 species which range north of Newfoundland	50°	89°
(D) 27 species which occur in Newfoundland but not in Labrador	44	83

Of these, C is doubtless a mixture of Arctic and Hudsonian; and D may be largely Canadian.

Nova Scotia and New Brunswick are entirely in the Cold Temperate Subregion (Canadian Fauna) of Allen but Merriam recognizes Alleghanian Zone of the Austral as well as Canadian Zone of his Boreal Region. The geographic averages of 152 plants from there may be analyzed as follows.

¹The geographic average in North America (including Greenland) of 20 Labrador plants that occur in Greenland is 54° N., 81° W.

²His map, 1912, *Canadian Entomologist*, XLIV, opposite p. 128, shows some yellow and blue, indicating Upper Austral and Transition. I do not know whether he meant this or whether it is due to faulty registration of the color-plates in printing.

	Average Latitude	Average Longitude
(E) 56 species that occur also in Labrador	50°	90°
(F) 26 species that occur also in Newfoundland but not in Labrador	44	85
(G) 70 species that occur in neither Labrador nor Newfound- land	42	86

Of these, E probably represents a mixture of Arctic and Hudsonian species that extend south; F may be largely Cold Temperate (Canadian) species; and G may be Alleghanian.

The geographic average for 207 New England plants is stated above to be 42° N., 85° W. Analyzing it in the same way as was done above for the material from Nova Scotia and New Brunswick, we get the following results.

	Average Latitude	Average Longitude
(H) 40 species that occur also in Labrador	48°	89°
(I) 24 species that occur also in Newfoundland but not in Labrador	44	84
(J) 69 species that occur also in Nova Scotia or New Brunswick but not northeast of there	42	86
(K) 74 species that do not occur northeast of New England	39	84

Four classes of plants may be considered to be present here: probably largely Hudsonian with a geographic average of 48° N., 89° W.; the Canadian with a geographic average of 44° N., 84° W.; the Alleghanian with a geographic average of 42° N., 86° W.; and an element of warmer-region plants with a geographic average of 39° N., 84° W. This last element is probably to be identified with Allen's Carolinian Fauna of the Humid Province of the Appalachian Subprovince of the Warm Temperate Subregion, or with the Carolinian of Merriam's Upper Austral.

The following is an analysis of the geographic averages of 282 plants that occur in Maryland, Virginia, or Delaware.

	Average Latitude	Average Longitude
(L) 12 species that occur also in Labrador	46°	89°
(M) 11 species that occur also in Newfoundland but not in Labrador	42	84
(N) 57 species that occur also in Nova Scotia or New Bruns- wick but not northeast of there	41	86
(O) 150 species that do not occur northeast of New England	38	84
(P) 52 species that do not occur northeast of Md.	34	84

What is apparently a new element (P) here might be considered to be the coming in of plants that would be classed in Allen's Austroriparian Subprovince (Louisianian Fauna) of the Humid Province of the Warm Temperate Subregion or of Merriam's Austroriparian Fauna of the Lower Austral Zone. As they are only the more northern species, the latitudinal average for this distributional section as a whole is doubtless less. O may be largely Carolinian; N, Alleghanian; L and M each have too few species to make the averages even approximately trustworthy.

Collecting the data, we get the following provisional suggestions as to the latitudinal averages for various regions.

Arctic	More than 52° N.
Hudsonian	48 or 49° N. ¹
Canadian	44 or 45° N. ¹
Alleghanian	41 or 42° N. ¹
Carolinian	38 or 39° N.
Louisianian or Austroriparian	Less than 34° N.

The tabulation just given indicates, at first sight, that these regions are definite, concrete entities, but, when we bear in mind that they were derived by first grouping the data into disconnected lots, we realize that another grouping might fill in the gaps. Furthermore, they are averages in which we lose sight of the extremes of each group. On the other hand, as stated above, categories, even if only conventional, are often useful aids to thinking and it might be well if we had concrete expressions for our categories—something more definite and tangible than mere names. I believe that the "geographic average" is such a concrete expression. I do not mean to intimate that the figures just obtained should be considered final, even for the regions that have been studied here. Although they are based on considerable material, this material includes only a small part of the plants of these regions and it does not include any of the animals. Also, it includes only relatively small areas of each section ("zone" or whatever we wish to call it). Furthermore, altitude and other ecological conditions have been disregarded.

I have been unable to devise, as yet, satisfactory corrections for altitude. Doubtless it could be done in the following way. We could study a limited area containing a wide altitudinal range, for example,

¹It will be noted that these are south of the principal boundaries of the "zones" in question, as given in Merriam. The finger-like southern extensions of the zones along mountain ranges is one of the causes and the discrepancy will be less when the corrections for altitude have been worked out. However, it is a matter of little moment, since the geographic average need not necessarily fall within the area actually covered by the species or the aggregate of species under consideration.

North Carolina, Virginia, or the central part of Colorado or of California. We could then calculate the geographic averages for various altitudes, keeping other ecological conditions, such as soil, exposure, etc., as nearly uniform as possible. We might get, in this way, a fairly accurate, concrete expression for the known fact that going to higher altitudes is, faunistically and floristically, analogous to going to higher latitudes and we might also get a factor for modifying our data so that, instead of working with the exact latitude of a place on a mountain, we could work with a modified figure, the modification being greater as the altitude is greater. In much the same way, the geographic average lends itself to a study of other ecological conditions.

Having obtained fairly approximate expressions in average latitude and longitude for each of the zonal names that we care to accept as a matter of convenience, we can then say rather definitely whether a certain animal or plant belongs in a given zone or not. This can be done by a comparison of its geographic average with the geographic averages of the zones. In the same way we can say whether a given small area is in one zone or another—or between two of them. One of our common bumble bees, *Bombus americanorum*, has a geographic average of approximately 38° N., 92° W. Its latitudinal average would put it in Carolinian, on the basis of the tabulation given above. Its longitudinal average is greater (farther west) than the longitudinal average of the areas studied here having the same latitudinal average.

The matter of longitudinal average is important in connection with the change in humidity that occurs at about 100° W. in the United States. Allen made this the basis upon which he divided the Warm Temperate Subregion into Provinces (Humid and Arid). Merriam laid more stress on temperature than on humidity and considered the latter as causing merely a subdivision of certain of the zones that were based on temperature. I, personally, incline more to the former idea than to the latter, especially where the latitudinal average is less than about 40° N., but I do not yet have enough data to discuss the question further.

The present paper is intended to outline a method, rather than to state results obtained by the use of the method. This method of geographic averages is suggested as a better tool for the study of distribution than, for example, indicator species or percentages of species from one area occurring in another. Incidentally, it has been indicated that the named "regions," "zones," etc. are far from the definite entities that they often seem to be. At the same time, what are believed to be first approximations to concrete expressions have been obtained for some of them.

AMERICAN MUSEUM NOVITATES

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March 24, 1921

59.9, 735C (51.3)

DESCRIPTION OF A NEW SPECIES OF SEROW FROM YÜN-NAN PROVINCE, CHINA

By ROY CHAPMAN ANDREWS

Although it is not the purpose to publish extensively upon the collections obtained by the Asiatic Expeditions of the American Museum until the field work has been completed, it is desirable to describe such new species as may come to light from time to time in the preliminary examination of certain groups.

The splendid serow which I shot near Teng-yüeh, China, not far from the Burma frontier, is the first animal to be described from the Asiatic collections, and I take pleasure in proposing for it the name *Capricornis osborni*, in honor of the distinguished President of The American Museum of Natural History, Professor Henry Fairfield Osborn.

Capricornis osborni, new species

Type No. 43042, ♀ juv., Hui-yao (20 miles from Teng-yüeh), Yün-nan Province, China, May 9, 1917; Roy Chapman Andrews.

Forehead, cheeks, neck, breast, and body coal black. The white basal parts of the hairs show through to a certain extent but the general effect is jet black. A narrow margin of white 6 mm. wide on upper lips from middle of snout to corner of mouth. Above this white band but below and behind the nostril on each side, is a triangular tawny patch. The lower lip is margined with white which occupies all except the central half of the chin and extends behind the corner of the mouth in a long, gradually narrowing streak; this almost reaches the white throat-patch which is about 40 mm. in width.

The proximal part of each ear in front is strongly tinged with tawny but on the back this is less pronounced and the ear is largely black. The short mane is intense black like the body, stiff, erect and crest-like; the hairs are about 120 mm. in length. From the mane to the tail, the hair of the mid-dorsal line forms a well-defined ridge. The tail is black in the center with an admixture of tawny hairs; the tip is all black.

Inside of fore legs to hoofs, tawny; externally, black to the knees; front of "cannon bones" black except at the knees where the black is indistinct and suffused with tawny. Just above the hoofs, the blackish area is thinly sprinkled with light buff and posteriorly, between the dew claws and the hoof, it is all light buff. Buttocks tinged with tawny. Thighs almost to hocks, black with slight admixture of tawny. Inner side of hind legs to hoofs tawny. From hocks to opposite dew claws, anteriorly, the legs are tawny but with a suggestion of blackish, due to the hairs which are black on the basal half and tawny on the tips. From opposite the dew claws to the hoofs the black is pronounced and thinly interspersed with buff-tipped hairs. The area between the dew claws and the hoofs, posteriorly, is all buff.

There is no underfur present on any part of the body.

Skull badly broken. Measurements of skull: condylo-basal length, 257 mm.; least orbital width, 68; width of palate between first premolars, 37; length of horn on curve, 117; circumference of horn at base, 95. External measurements of type: head and body, 1350; tail, 180; hind foot, 390; ear, 175; height at shoulder, 950.

Capricornis osborni is undoubtedly allied to our specimens from Li-chiang, Yün-nan Province, which I have identified as *C. milne-edwardsi*. Its chief distinguishing characters are its coal-black body and head, its short black mane and the greater amount of black on the lower part of the legs. Our four specimens of *C. milne-edwardsi* all have brownish-black bodies and heads, long whitish manes, and little or no black upon the lower legs. In the very heavy mat-like gray mane, my two specimens of *C. argyrochætes* from Fukien Province, China, differ strikingly from *osborni*, although in the amount and disposition of the black on the lower legs the two somewhat resemble each other. *C. swettenhami* of the Malay Peninsula is distinguished from *osborni* by the black legs and the mane, which is a mixture of whitish, black and reddish hairs.

In discussing *C. milne-edwardsi* Mr. R. I. Pocock¹ has remarked: "A closely allied form apparently resembling typical *milne-edwardsi* in color except that the fronts of the cannon bones appear to be black has been recorded by Mr. H. Shaw Dunn from Kyonklongyi and other localities in the North Shan States of Upper Burma where it lives mostly in evergreen forests at altitudes of from 4,500 to 6,000 feet (Field, Jan. 9, 1909.)."

I have not been able to discover Mr. Dunn's communication in the 'Field' but I have no doubt that the race I am now describing is the one to which he refers.

The serow which Lieut. R. C. Beavan² described as inhabiting the vicinity of Moul-mein, Burma, and which Mr. Pocock referred provisionally to *milne-edwardsi* may be this new form. While the affinities of *osborni* are toward *milne-edwardsi*, it is interesting as showing an approach toward *swettenhami* of the Malay Peninsula in the considerable amount of black on the legs and the short black mane.

Near Genkang, Yün-nan Province, we purchased from a native a flat serow skin which lacks the head and lower legs. This specimen was said to have come from the mountains of Keng-ma about 200 miles southeast of Teng-yüeh and not far from the Burma frontier. It is brownish black

¹'The Serows, Gorals and Takins of British India and the Straits Settlements.' By R. I. Pocock. Part II. Journal, Bombay Natural History Society, XXII, pp. 307-308.

²1866, Proc. Zool. Soc. London, p. 4.

in general color, has a short crest-like, brownish-black mane, similar in character to that of *osborni*, and what remains of the skin shows that both the fore and hind legs were whitish or light buff below the knees and hocks.

This specimen may possibly represent the male of *C. osborni*, for the differences are somewhat similar to those between the male and female of our *C. argyrochaetes* from Fukien.

I shot *C. osborni* near the village of Hui-yao while hunting monkeys on the precipitous bank of the river. The cliff was almost perpendicular and was covered with a tangled jungle growth. Now and then the rock wall would become less precipitous and the thick cover give place to an open grassy slope. It was when I was about to cross such an opening that the serow dashed out of the bushes where it had evidently been feeding. I fired just before it disappeared over the rim of the gorge and it sank in its tracks, gave a convulsive twist, and plunged into the canyon. It was recovered with considerable difficulty.

Although the natives knew that serows lived in this part of the gorge, few of them had ever seen one and it was an object of great curiosity in the village.

There is little change in the country between Hui-yao and the Burma frontier and no reason why *C. osborni* should not have an unrestricted range into Burma.

AMERICAN MUSEUM NOVITATES

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59.82 (67.5)

DESCRIPTIONS OF FOUR NEW BIRDS FROM THE BELGIAN CONGO¹

BY JAMES P. CHAPIN

This is the fifth preliminary paper on the ornithological results of the Congo Expedition of the American Museum and consists of descriptions of four new forms from the Ituri and Upper Uele Districts of the Belgian Congo. The special color-names employed are taken from Ridgway's 'Color Standards and Color Nomenclature' (1912).

I am obliged to the Carnegie Museum and the courtesy of Mr. W. E. Clyde Todd for the loan of specimens for comparison; and permission has been kindly granted me to examine other material in the U. S. National Museum and the Philadelphia Academy of Natural Sciences.

Astur toussenellii canescens, new subspecies

SUBSPECIFIC CHARACTERS.—Differs from *A. t. toussenellii* (Verreaux) in being slightly larger and much paler, especially below. Easily distinguished by its pale gray, instead of rufous, thighs.

TYPE.—No. 157743, A. M. N. H., ♀ ad., Medje, in northern Ituri District, Belgian Congo, June 28, 1910.

ADULT FEMALE (type).—Crown deep gull-gray, shading gradually to slate-gray on the back; slate-color on the wing-coverts, and dark neutral gray on the outer webs of primaries and secondaries. Primaries beneath light gray with narrow bars of brownish black, on the secondaries these bars disappear, and the color becomes gray fading to white on the basal half of inner webs. Under wing-coverts white, irregularly marked with gray. Rump like the back, upper tail-coverts slightly darker, and median rectrices slate-black, with three large spots of white on the inner web, and a white tip. The outermost tail-feather, about 30 mm. shorter than the middle, is blackish brown, almost uniform, but whitish at the very base on inner web, the remaining feathers have three broad bars of black, with three lighter bars, white on inner web, and a whitish tip. The gray of the crown becomes lighter and bluer on the cheeks, shading to pale gull-gray on the throat; whole of breast and flanks uniform orange-cinnamon, shading to grayish white on abdomen; under tail-coverts white. Thighs pale gull-gray, a few of the feathers with a very slight vinaceous wash. Iris bright orange; eyelids, lores, and cere, yellow; bill horn-blue, with tip black; feet yellow, claws black.

Length (skin), 428 mm.; wing, 234; tail, 203; bill (culmen from cere), 20, (including cere), 27; metatarsus, 65; middle toe with claw, 54.

¹Scientific Results of the American Museum Congo Expedition. Ornithology, No. 5.

ADULT MALE.—No. 157741, A. M. N. H., Avakubi, Ituri, January 20, 1914. Smaller, and more brightly colored on the breast, but thighs likewise pale gray. Iris bright reddish orange. Wing, 199 mm.; tail, 173; bill (from cere), 15, (from base), 22; metatarsus, 57.

IMMATURE BIRDS, from Ituri District, are blackish brown above, white below with dark spots and bars at sides, but unmarked on throat and middle of breast.

Specimens Examined—*Astur t. canescens*. Belgian Congo, Ituri: Avakubi, 1 ♂ ad., 1 ♀ ad., 1 ♀ im.; Medje, 1 ♀ ad.; Uele: Niangara, 1 ♀ im.

Astur t. toussenellii. Gaboon: Fernand Vaz, 1 ♀ ad. Also Plate VI, Cat. Birds Brit. Mus., I, 1874.

Astur sparsimfasciatus. Belgian Congo, Uele District: Aba, 1 ♀ ad.; Faradje, 1 ♀ im.

Astur castanilius. Belgian Congo, Ituri District: Gamangui, 1 ♂ ad.; Medje, 2 ♀ im.

Astur toussenellii canescens is widely distributed in the Ituri Forest, replacing *A. t. toussenellii* of the forested regions further west. It ranges northward at least to Niangara in the Uele District.

***Colius nigricollis leucophthalmus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Colius nigricollis nigricollis*, but the hind neck and upper back barred with dark brown, and iris white instead of brown.

TYPE.—No. 158840, A. M. N. H., ♂ ad., Niangara, Uele District, Belgian Congo, November 16, 1910.

ADULT MALE (type).—Forehead, lores, and chin black; crown, crest and ear-coverts vinaceous-buff (Ridgway); hind-neck and upper back light drab, finely barred with dark brown; scapulars, wing-coverts and outer surface of remiges olive-brown; rump slightly lighter, with a few indistinct bars; upper tail-coverts still lighter brown, with distinct blackish bars. Rectrices olive-brown, the two small outer pairs with broad white exterior margins. Throat black in middle, each feather with a gray central spot; these spots growing larger laterally and posteriorly so that the sides of the throat become light gray barred with dusky, the chest drab-gray barred with dark brown. The color of the underparts shades gradually to a uniform cinnamon-buff on belly and thighs, the breast and sides of body being vinaceous-buff barred with brown. Bases of remiges from below cacao-brown, greater wing-coverts similar, but marginals duller and paler. Iris grayish white; rim of eyelids and skin at base of maxilla black, naked areas behind eye light blue; maxilla black with a spot of bluish gray on basal half of culmen; mandible pale buff, but black at sides of base; feet scarlet, claws black.

Length (skin), 310 mm.; wing, 92; tail, 209; exposed culmen, 14; metatarsus, 21.5; middle toe with claw, 26.

There is no appreciable difference between the sexes in color or size. Eighteen males of *C. n. leucophthalmus* measure as follows: Wing, 87–96 (93.1)¹; tail, 179–221 (202.8); exposed culmen, 12.5–14 (13.3); metatarsus, 21–24 (21.9).

¹Averages in parentheses.

Six females of *C. n. leucophthalmus* measure: Wing, 86-97 (93); tail, 184-226 (208.4); exposed culmen, 13-14 (13.1); metatarsus, 21-23 (22).

Five specimens of *C. n. nigricollis* from Leopoldville and Boma, Lower Congo, including both sexes, measure: Wing, 92-99 (95.2); tail, 190-206 (198.6); exposed culmen, 13-14 (13.2); metatarsus, 21-23 (22.2).

SPECIMENS EXAMINED.—*Colius nigricollis nigricollis*. Lower Congo: Boma, 1 ♂ ad., 2 ♀ ♀ ad.; Leopoldville, 2 ♂ ♂ ad. Cameroon: Bitye, River Ja, 1 ♂ ad., 1 ♀ ad.; Lolodorf, 7 ♂ ♂ ad., 6 ♀ ♀ ad., 1 juv. Also Pl. 259, Levillant, 'Oiseaux d'Afrique,' VI, 1808.

Colius nigricollis leucophthalmus.—Belgian Congo, Ituri: Bafwabaka, 4 ♂ ♂ ad.; Medje, 6 ♂ ♂ ad., 3 ♀ ♀ ad., 2 ♂ ♂ juv., 4 ♀ ♀ juv.; Uele: Niangara, 2 ♂ ♂ ad.; 4 ♀ ♀ ad.; Vankerckhovenville, 3 ♂ ♂ ad., 2 ♀ ♀ ad.; Faradje, 3 ♂ ♂ ad.; Garamba, 1 ♀ juv.

Colius striatus striatus.—South Africa: Natal, 5 ad.

The type locality of *Colius nigricollis* Vieillot is Malimbe, in the Portuguese Congo,¹ on the southern edge of the West African forest. Not only is this black-throated Coly known from the adjoining Lower Congo District, but there are many published records from the Cameroon, mostly north of the forest, from the Shari River, and even from the Uele District, the Upper Ituri, and Lake Kivu. Selater and Mackworth-Præd² have identified as *C. striatus nigricollis* specimens from Mt. Baginzi, Meridi, and Kojali in the Bahr-el-Ghazal Province. The range of these Colies extends around rather than through the Congo forests, though they are found in clearings in the Gaboon and Southern Cameroon; and the form occurring to the northeast, in the Upper Uele District, differs markedly from *C. n. nigricollis* as found near the type locality.

Five adult specimens were collected by the American Museum Congo Expedition at Leopoldville and Boma, on the Lower Congo, in 1909 and 1915. In the four cases where the color of the eye was noted it was always dark brown. Reichenow³ and L. Petit⁴ likewise describe the eye as brown, but Levillant stated that he did not know its color.

In adult birds from the northern Ituri and the Uele District, of which we collected a much larger number, the iris is invariably white or grayish white, and this is well shown in the photograph from life (Fig. 1). Only in young birds is it grayish brown. The colors of the bill and naked skin of the face appear to be identical in the two forms.

¹Levillant, 1808, 'Oiseaux d'Afrique,' VI, Pl. cclix, and Vieillot, 1817, 'Nouv. Dict. d'Hist. Nat.,' VII, p. 378.

²Ibid., 1919, p. 650.

³1903, 'Vögel Afrikas,' II, p. 204.

⁴1899, Mém. Soc. Zool. France, XII, p. 68.



Fig. 1. *Colius nigricollis leucophthalmus*, ♂ ad., Niangara, Uele District, Belgian Congo, December 3, 1910.

Photograph by H. Lang, from life, showing white iris.

There is also a conspicuous difference in plumage between specimens from the Lower Congo and those from the Ituri and Uele. Typical *C. nigricollis* has the hind-neck and back of a uniform brown, as is clearly stated by both Levaillant and Vieillot, the original description¹ reading: "le dessus du cou et le manteau d'un brun uniforme, plus foncé sur les ailes; les côtés du cou, la poitrine, et les flancs du même brun, et rayés transversalement d'un noir lavé." There may, indeed, be faint indications of barring, but these are due to the structure of the feather rather than to pigmentation.

The birds from the Uele and Ituri are usually more heavily barred on the breast, and this fine barring always extends around on the hind neck and upper back. They are not *C. n. nigriscapalis* Reichenow, for they agree with *C. n. nigricollis* in the color of head and under wing-coverts.

¹1817, 'Nouv. Dict. d'Hist. Nat.,' VII, p. 378.

Of *Colius n. nigricollis* from the Cameroon I have examined two specimens in the Philadelphia Academy from the River Ja (G. L. Bates), and thirteen adult specimens from Lolodorf (J. A. Reis), loaned me by the Carnegie Museum. The color of the iris was noted by Bates as grayish brown (♂) and brown (♀), and by Reis in one case as chestnut-brown (♂). With regard to plumage, these birds from the Cameroon agree exactly with *C. n. nigricollis* from the Lower Congo.

For the present, the range of *Colius nigricollis leucophthalmus* may be stated as follows: Savannah region of the northeastern Congo Basin, from the Nepoko River northward to the southern border of the Anglo-Egyptian Sudan, and probably extending to the westward along the northern edge of the forest, as well as southward along its eastern border to Lake Kivu.

***Batis ituriensis*, new species**

SPECIFIC CHARACTERS. —Most nearly related to *B. minima* (Verreaux) from the Gaboon, but differs in having a broad, glossy-black breast-band and a distinct white nuchal spot. Smaller than any species of *Batis* except *B. minima* and *B. perkeo* Neumann¹; but the female of the latter has a brown breast-band.

TYPE.—No. 159881, A. M. N. H., ♀ ad., Gamangui, on Nepoko River, Ituri District, Belgian Congo, February 4, 1910.

ADULT FEMALE.—A large white patch at each side of forehead, but lores, fore part of crown, and postocular region pure black. Posterior half of crown grayish black, bordered laterally by a lighter line of mixed gray and white, which does not extend forward to the eye. Feathers of nape white, tipped with gray; back dark gray, scapulars blacker, rump with oval spots of white; upper tail-coverts black. Wings black, with a conspicuous white stripe running from the outer median coverts, across the greater coverts, and down the outer margins of three inner secondaries; under wing-coverts white save at margin of wing, where they become black. Tail black, the outermost feather widely margined with white, the next two with a narrow white edge, and a small white speck at the tips of other feathers. Under surface white, save for a glossy-black breast-band, 8 mm. wide, and blackish mottling at sides of body. Feathers of tibiae black, tipped with white. Iris yellow; bill and feet black.

Length (skin), 85 mm.; wing, 48.5; tail, 30; exposed culmen, 11.5; metatarsus, 14.

SPECIMENS EXAMINED.—*Batis ituriensis*. Belgian Congo, Ituri: Gamangui, 1 ♀ ad.

Batis minima. No specimens available, only descriptions by Verreaux, 1855, *Revue et Magasin de Zoologie*, (2) VIII, p. 219, and by Sharpe, *Ibis*, 1873, p. 169.

Batis minulla. Belgian Congo, Middle Congo: Suata, 1 ♂ ad.

Batis diops O. Grant. 1910, *Trans. Zool. Soc.*, XIX, Pl. xviii, fig. 2.

Batis molitor puella. B. E. Afr.: Guasonarok, N. Guaso Nyiro, 1 ♂ ad.; Kijabe, 1 ♂ im.

¹1907, *Journ. f. Ornith.*, LV, p. 352.

Batis bella nyansæ. Belgian Congo, Uele: Niangara, 3 ♂♂ ad., 2 ♂♂ juv.; Faradje, 3 ♂♂ ad., 2 ♀♀ ad., 2 ♂♂ juv.

Batis bella congolensis. Belgian Congo, Middle Congo: Kwamouth, 1 ♀.

Our single specimen was taken on the border of a clearing in the forest, where no other species of *Batis* was ever observed. Verreaux remarked¹ that *Batis minima* was found in similar situations in the Gaboon. The type of *B. ituriensis* was sexed by me, and I believe that the male and female will prove to be similar in coloration, as they are in *B. diops*. Inasmuch as the male of *minima* is described by both Verreaux and Sharpe as having a greyish-black band across the breast, the present specimen cannot be referred to that species, in spite of its agreement in size. Moreover, the type localities are approximately 1200 miles apart and no specimens of *B. minima* have ever been taken in the intervening territory.

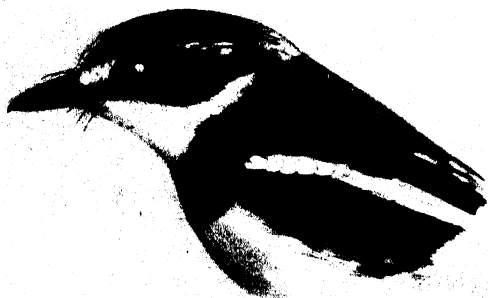


Fig. 2. *Batis ituriensis*, ♀ ad.
Natural size.

***Terpsiphone batesi*, new species**

SPECIFIC CHARACTERS.—Resembling *T. rufocinerea* Cabanis, with a similar, slightly marked crest but always short-tailed, even in the adult male, where the middle pair of rectrices exceeds the second pair by 14.5 mm. at most, on an average by only 8.9 mm. The head is lighter gray, the back brighter rufous than in *rufocinerea*.

TYPE.—No. 160095, A. M. N. H., ♂ ad., Medje, northern Ituri District, Belgian Congo, March 31, 1910.

ADULT MALE (type).—Back, wing-coverts, inner secondaries, outer edges of all remiges, rump and all feathers of tail bright burnt sienna; under tail-coverts bright orange-rufous. Whole head, throat, and hind neck slate-color, with a noticeably

¹1855, *Revue et Magasin de Zoologie*, (2) VIII, p. 219.

bluer sheen on feathers of crest, which is rather short and rounded, the longest feathers measuring 11.5 mm. Breast, flanks, and abdomen slate-gray, feathers immediately around vent whitish. Inner webs of remiges brownish black, bordered basally with rufous; under wing-coverts largely gray, but longer ones whitish, and the greater coverts with a slight rufous tinge.

Iris dark brown; rim of eyelids slightly expanded, and blue; bill blue with black tip; feet grayish blue.

Length (skin), 175 mm.; wing, 74.5; tail (middle feathers), 94.5, (next pair), 80, (outermost), 65.5; exposed culmen, 14; metatarsus, 15.

Measurements of six adult males are as follows: Wing, 73-77 (74.9)¹; tail (middle feathers), 78-94.5 (88), (next pair), 75-83.5 (79.1); exposed culmen, 12.5-14 (13.5); metatarsus, 14-15.5 (14.9).

ADULT FEMALE.—Somewhat duller and paler, crest without gloss, back Sanford's brown, middle of abdomen paler gray. Dimensions of three adult females are: Wing, 72-73.5; tail (middle feathers), 73.5-75, (next pair), 71; exposed culmen, 12-13; metatarsus, 14-15.5.

SPECIMENS EXAMINED.—*Terpsiphone batesi*. Belgian Congo, Distr. of Stanleyville: Bafwasende; 1 ♂ ad.; Ituri: Avakubi, 3 ♂ ♂ ad.; Bafwabaka, 1 ♂ ad., 2 ♀ ♀ ad.; Medje, 1 ♂ ad., 2 ♀ ♀ ad. Cameroon: Bitye, ♂ 1 ad., 1 ♀ ad.; Assobam, 1 ♂ ad.

Terpsiphone rufocinerea. Belgian Congo, Lower Congo: Boma, 2 ♂ ♂ ad., 2 ♂ ♂ im., 1 ♀ im. Spanish Guinea: Rio Muni, 2 ♂ ♂ ad. Gaboon: Rio Moondah, 1 ♂ ad., 1 ♀.

Terpsiphone plumbeiceps. Belgian Congo, Distr. of Stanleyville: Bengamisa, 1 ♂ ad.; Uele: Vankerekhovenille, 1 ♂ ad. Nyassaland: Zomba, 1 ♂.

Terpsiphone batesi is a common and characteristic bird of the Ituri Forest, at least from Bafwasende on the River Lindi and Avakubi on the Ituri northward to Medje and the River Nava. It associates with *T. ignea* in the mixed flocks of insectivorous birds that wander through these shady solitudes; but does not venture forth into clearings around villages. Eastward, it extends to Ukaika and between Mawambi and Irumu, whence Sassi reports specimens collected by Grauer² under the name of *T. rufocinerea*. Westward, it reaches at least to Bitye on the River Ja, South Cameroon, as proved by two specimens in the Philadelphia Academy of Natural Sciences, collected by G. L. Bates and labeled also as *T. rufocinerea*.

Among the many names proposed for species of *Terpsiphone*, only *rufocinerea* has ever been applied to this one, and I therefore take pleasure in naming it in honor of Mr. G. L. Bates, who has made such invaluable contributions to African ornithology.

T. rufocinerea was described by Cabanis³ from Chinchoxo, Loango Coast, and I have collected specimens not very far away, at Boma, on

¹Averages in parentheses.

²1916, Ann. K. K. Naturhist. Hofmus., XXX, p. 258.

³1876, Journ. für Ornithologie, p. 236.

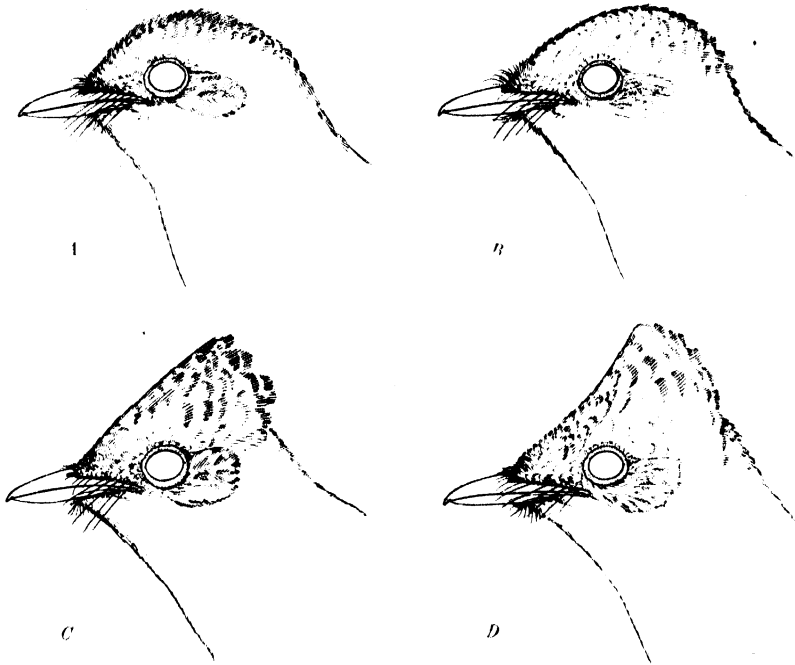


Fig. 3. Heads of adult males in four species of *Terpsiphone*, showing form of crest.

A.—*T. rufocinerea*. B.—*T. batesi*. C.—*T. plumbeiceps*. D.—*T. viridis*. $\times \frac{1}{2}$.

the Lower Congo. The latter agree with the original description in every respect, and one of Cabanis' two types is stated to have had the middle rectrices greatly lengthened, as they are in my adult males. In the collection of the Philadelphia Academy there are likewise four specimens of *T. rufocinerea* from the Du Chaillu Collection, taken at Rio Moonda, on the west coast. Two of these have long rufous tail-feathers, and one is remarkable in having several greater wing-coverts on both sides black, bordered with white.

Our nine adult specimens of *T. batesi* and the three I have examined from the Cameroon show a striking uniformity in their distinctive characters.

From *T. plumbeiceps* the species here described as new may be known by its shorter crest, bright rufous under tail-coverts, and short tail. It differs from *T. schubotzi*, if Prof. Reichenow's description¹ is

¹1911, Orn. Monatsberichte, XIX, p. 82.

exact, in its bluish gray breast, and from the recently described *T. poliothorax* Reichenow¹ in having the head grayish, not black, and abdomen gray, not rufous.

It bears some resemblance to females and young of *T. perspicillata* and *T. viridis*, but is at once separable by its much brighter rufous back and paler head with more rounded crest. The form of the crest in the different species of *Terpsiphone* is very characteristic, and Figure 3 shows its general outline in four of the species here mentioned.

¹1916, Journ. für Ornithologie, LXIV, p. 161.

AMERICAN MUSEUM NOVITATES

Number 8

June 3, 1921

59.51,7 (67.5)

POLYCHÆTOUS ANNELIDS COLLECTED AT ST. PAUL DE LOANDA BY THE AMERICAN MUSEUM BELGIAN CONGO EXPEDITION¹

BY A. L. TREADWELL

Several families of polychætous annelids are represented in the collection.

The Nereidæ are *Nereis pelagica* Linnæus and *N. tongatabuensis* McIntosh.

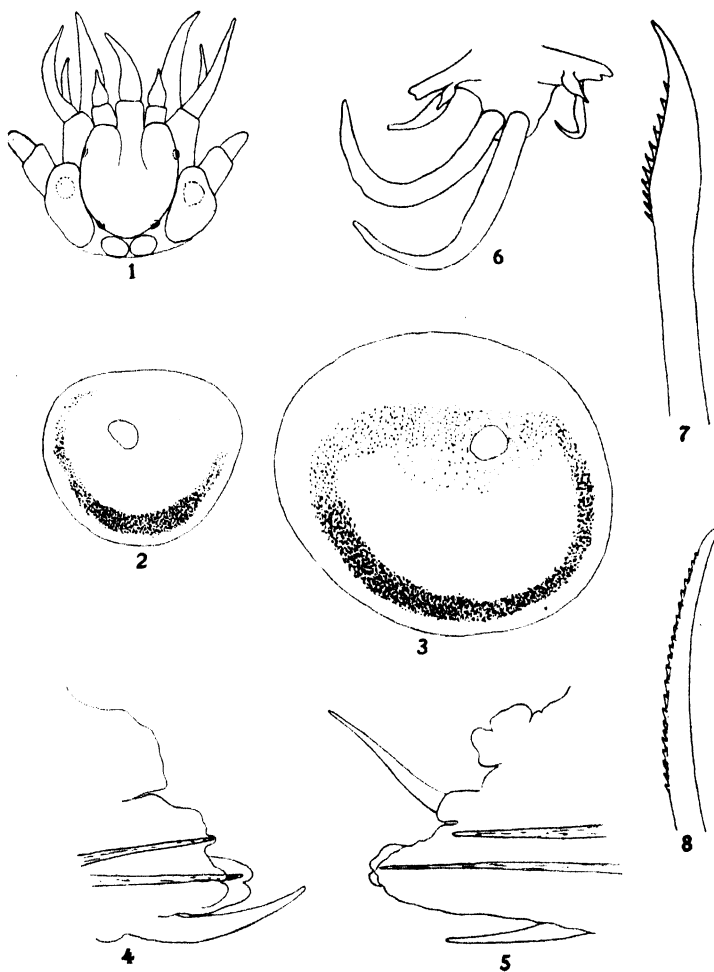
Of the Leodicidæ, *Diopatra neapolitana* Delle Chiaje is represented by a single specimen, and there is a fragment of a tube of some leodiceid. There are a few fragments of *Chætopterus*, too much injured for identification, and a considerable number of specimens of *Dasychonopsis* (*Dasychone*) *bairdii* McIntosh. The appearance of this last species is unexpected, since it was first described from the West Indies, but it is evident that a sessile species like this might be easily transported on the bottom of ships.

Of the Polynoidæ there are several specimens of *Lepidonotus clara* Montagu, and a single mutilated specimen of a *Harmothoë*, apparently closely related to *H. fraser-thomsoni* of McIntosh ('Monograph of the British Annelids,' Pt. II, 'Polychætes.' Ray Society, 1900, p. 337), but the elytra lack the large tubercles found on one side only, which McIntosh describes from that species. The appendages of the head were entirely lost and close comparisons are not possible. A species of *Acholoë* is new and its description follows.

***Acholoë orbiculata*, new species**

The animals were all very much coiled in a close spiral, which made counting of the somites and exact determination of the length difficult. So far as I could determine, the body is about 50 mm. long, and the average specimen has a prostomial width of 0.5 mm. There are 45 or 46 elytra covering the entire dorsal surface of the body to the extreme posterior end. In the preserved material the elytra have a ground color of a pearly white, with pigment over the elytrephore in a somewhat diffuse patch, while from this patch a narrower and much more sharply defined band extends around the elytron, leaving the margin uncolored. In the entire animal the diffuse part of the pigment is covered in each elytron by the overlapping of the one anterior to it, so that the most striking feature is the succession of ringed elytra. In the first elytron the diffuse patch around the elytrephore does not occur.

¹Scientific Results of the American Museum Congo Expedition. General Invertebrate Zoology, No. 7.



Figs. 1 to 8. *Acholoë orbiculata*, new species.

- Fig. 1. Anterior end, $\times 22.5$.
 Fig. 2. First elytron, $\times 22.5$.
 Fig. 3. Posterior elytron, $\times 22.5$.
 Fig. 4. First parapodium, $\times 45$.
 Fig. 5. Later parapodium, $\times 22.5$.
 Fig. 6. Anal cirri, $\times 45$.
 Fig. 7. Ventral seta, $\times 185$.
 Fig. 8. Dorsal seta, $\times 185$.

The prostomium (Fig. 1) is oval in outline, a little longer than broad, and with the anterior margin on either side rounded instead of being prolonged into peaks. The median tentacle is carried on a large cirrophore, which is inserted in the front of the prostomium, its terminal joint being only about twice as long as the cirrophore, tapering gradually to an acute point. The cirrophores of the lateral tentacles apparently arise on the level of the margin of the prostomium, but are really very slightly below it. The cirrophore is about as long as the terminal joint, which is acutely conical. The palps are rather slender, extending beyond the tentacles. The dorsal tentacular cirrus is larger than the ventral and extends about to the apex of the palp. Both palps and tentacular cirri have a few colorless papillae, visible only under a magnification of 75 to 100 diameters. The large first elytraphores bound the prostomium postero-laterally and there are two pairs of eyes, one pair at the posterior margin, and the other pair toward the anterior end. From a dorsal view, these appear to be very small, though they are really of a moderate size, but lie far enough under the curve of the prostomium to be partly hidden from the dorsal view.

Dorsal cirri (Fig. 5) are long and slender. There is one pair of anal cirri, rather stout processes, arising from the ventral surface of the pygidium (Fig. 6). The first elytron (Fig. 2) differs from later ones (Fig. 3) only in size and in the lack of the diffuse pigmentation around the elytraphore. All elytra have smooth margins and no trace of surface papillae.

The first parapodium (Fig. 4) has dorsally the elytraphore of the first elytron. The notopodium is smaller than the neuropodium and carries a single acicula and a tuft of setae of the sort shown in Fig. 8. The setal portion of the neuropodium has an anterior and a posterior lip, the former being the larger, with an acicula a trifle larger than the notopodial, and a tuft of setae like those in Fig. 7. The slender ventral cirrus extends beyond the end of the parapodium. A posterior parapodium (Fig. 5, drawn to a scale one half that of Fig. 4) has much the same outline as that of the first, but is much larger, and in the case of cirrus-bearing somites, as is shown in the figure, there is a slender dorsal cirrus, extending beyond the apex of the parapodium. Dorsal to the cirrus, on the body wall, is a fold which was somewhat distorted in outline in the specimen figured, but which, on a surface view of the entire animal, has an outline like that of a hammer head. This is apparently a respiratory organ.¹

The dorsal setae (Fig. 8) are smaller than the ventral, with a bluntly rounded shaft, carrying toward the apex two rows of teeth, each tooth in the form of a narrow plate denticulated on its margin. Only one of these rows of teeth can be seen in the profile view shown in the figure. The ventral setae (Fig. 7) are much larger with their shafts heavier, and enlarged near the apex. Along this enlarged portion, extend two rows of teeth like those on the dorsal setae. As in the latter case only one row appears in profile.

¹The presence of processes like these led Grube (1855, 'Beschreibung neuer oder wenig bekannter Anneliden,' Wiegman, 'Archiv. f. Naturgesch.', 1, p. 81) to describe as *Polynoe malleata* a form from Trieste. McIntosh has later (1900, 'Monograph of the British Annelids,' Pt. II, Ray Society, p. 397) identified this with Claperede's *Acholoë astericola*, a form apparently closely related to *A. orbiculata*, but differing from it in the character of the elytra. In his diagnosis of the genus *Acholoë*, McIntosh (*loc. cit.*, p. 396) states that the dorsal cirri occur on every foot, but in his description of *A. astericola* he says that the T-shaped lobes occur in the cirriferous feet. In *A. orbiculata* I find that, as is the rule, elytron-bearing somites alternate with cirriferous ones. Grube's original description of *Polynoe malleata* stated that there are 39 elytra, while McIntosh gives 45 as the number in *A. astericola*, but the latter author regards the two as synonymous. The arrangement of setae is the same in the posterior as in the anterior somites, and there is a slender ventral cirrus, not differing much in outline from the anterior ones, but very much shorter.

AMERICAN MUSEUM NOVITATES

Number 9

June 3, 1921

59.9,51M:14.98,2

A REMARKABLE CASE OF EXTERNAL HIND LIMBS IN A HUMPBACK WHALE

By ROY CHAPMAN ANDREWS

In July 1919, a female Humpback Whale (*Megaptera nodosa*) with two remarkable protrusions on the ventral side of the body, posteriorly, was captured by a ship operating from the whaling station at Kyuquot, on the west coast of Vancouver Island, British Columbia.



Fig. 1. Caudal part of the whale, showing the hind limb *in situ*.

One of the protrusions was cut off by the crew of the vessel but the other was photographed *in situ* by the superintendent of the Station. Mr. Sidney Ruck and Mr. Lawson, officials of the Consolidated Whaling Company, appreciated the importance of the discovery and presented the skeletal remains of the attachment to the Provincial Museum, Victoria, B. C.

At my request, Mr. Francis Kermode, Director of the Provincial Museum, very courteously submitted the bones to me with permission to publish upon the result of my examination.

Under date of March 4, 1920, Mr. Ruck writes to Mr. Kermode as follows:

I enclose herewith three photographs showing the unusual development of the pelvic Rudiments in a whale captured at the Kyuquot Station last July, of which you have the bones. It is to be regretted that better pictures in evidence of this unprecedented development were not obtained.

I have been connected with the Whaling Industry for 22 years and during my time have come in contact with prominent Naturalists such as Professor True of the Smithsonian Institute, Professor Lucas of the Natural History Museum, Brooklyn,¹ and Professor Andrews of the Natural History Museum, New York, and neither in their experience or mine have the protrusion of the pelvic bones beyond the body ever been seen or heard of.

This particular whale was a female humpback of the average length with elementary legs protruding from the body about 4 feet 2 inches, covered with blubber about one-half an inch thick.

As shown in the best photograph these legs protruded on either side of the genital opening; the left leg was cut off by the crew of the vessel and lost, and the point at which it was cut off is clearly shown in the photograph. The end of the leg seen in the picture terminated in a kind of round knob like a man's clenched fist.

The two bones of the leg which you have are connected by cartilage which I was informed had shrunk about 10 inches, and possibly more by this time. At any rate the total length of the leg before it was cleaned of the blubber and flesh was, as before stated, about 4 feet, 2 inches, from the body.

After studying the material and discussing it with various scientists, I have come to the conclusion that the protrusions actually do represent vestigial hind limbs and show a remarkable reversion to the primitive quadripedal condition.

I am well aware that zoologists are inclined to accept reported instances of reversion with extreme reluctance and that, at first sight, the tendency will be to consider this a teratological case of no reversionary significance, but the evidence is so strong that I can not interpret it in that way.

Mr. Ruck reports that the total length of the leg "before it was cleaned of the blubber and flesh" was about four feet and two inches. The skeletal remains in my possession consist of two bones and two heavy cartilages. When placed in position as in Fig. 2, the total length is 31 inches.

¹Then of the U. S. National Museum, now of The American Museum of Natural History.



Fig. 2. Skeleton of the hind limb.

Fig. 3. Cartilaginous femur and osseous tibia.

Fig. 4. Cartilaginous tarsus and osseous metatarsal.

FEMUR.—The larger bone is deeply concave proximally and to it is attached a massive cartilage (Fig. 3) which, in its present shrunken condition, is $5\frac{1}{4}$ inches in length and $1\frac{1}{2}$ inches wide. I estimate that this cartilage was at least 15 inches long and 3 inches wide when fresh. I believe that this cartilage represents the femur. It probably lay entirely within the body, its proximal end being attached to the pelvic vestiges. Such a massive cartilage must necessarily have had a firm support and leads me to believe that the pelvic elements in this individual were of extraordinary size. The pelvic bones, as usually present in the *Megaptera*, are slender ossifications about 6 or 8 inches in length and would not furnish a firm enough base for the attachment of a cartilage which, in its fresh condition, was as large as a man's wrist.

Since the photograph of the limbs *in situ* shows that they were directly below the usual location of the pelvic vestiges and since there are no other "floating" bones near this region, the conclusion that they were attached to the pelvic elements is entirely justifiable.

TIBIA.—The larger of the two bones I identify as the tibia (Fig. 3). It is $14\frac{1}{4}$ inches in greatest length, is well developed, and has a hard, smooth outer surface. At the proximal end its greatest width is $3\frac{3}{4}$ inches, it narrows gradually for three-fourths of its length, and then suddenly expands at the distal extremity, where it is $2\frac{1}{2}$ inches wide.

TARSUS.—The distal end of the tibia is convex and gives attachment to a cartilage which in its shrunken state is $4\frac{1}{4}$ inches long and $1\frac{1}{4}$ inches wide (Fig. 4). This cartilage, I believe, represents the tarsus. That it presents no ossifications is by no means surprising as the carpal bones in the fore limbs of cetaceans are sometimes entirely absent and often in a more or less rudimentary condition. Mr. Ruck says "the two bones of the leg which you have are connected by cartilage which I was informed had shrunk about 10 inches and possibly more by this time." This would give the tarsal cartilage a length of nearly 15 inches.

METATARSAL.—The distal element in the leg is a hard, well-developed bone which I identify as a metatarsal (Fig. 4). It has the characteristic shape of the metacarpals in the fore limbs of cetaceans except that it is more slender. It is $6\frac{1}{2}$ inches long, $1\frac{1}{4}$ inches wide proximally, and $1\frac{1}{8}$ inches in distal width; its least width is $\frac{15}{16}$ of an inch. To the distal end of the metatarsal is attached a heavy cartilage of which only $\frac{3}{4}$ of an inch remains intact. This cartilage probably formed the extremity of the limb skeleton.

EXTERNAL APPEARANCE OF THE LIMB.—In reference to the limb as it appeared in the fresh condition, Mr. Ruck says that the end terminated in a "kind of round knob like a man's clenched fist," that the total length was about four feet and two inches, and that it was covered with blubber about one-half inch thick. I infer from Mr. Ruck's description that the connective tissue and blubber were essentially the same as in the flipper, or fore limb, of cetaceans. The photograph of the limb *in situ* (Fig. 1) show that there are two prominent, truncated tuberosities on the distal half. The proximal "bunch" evidently indicates the distal end of the tibia and the other is at the extremity of the metatarsal. These tuberosities may very properly be homologized with those on the outer, or anterior, edge of the flipper in the *Megaptera* which indicate the extremities of the radius and the second digit. This is, I believe, a point which has considerable significance.

Since the stalk-like cartilaginous femur probably lay entirely within the body and the remainder of the limb entirely outside, there was undoubtedly a certain flexibility at the point of junction with the body.

In a paper entitled 'Untersuchungen an walen,'¹ Professor W. Kükenenthal has described external rudimentary hind limbs in three early embryos of *Megaptera*. These appear as two more or less caudally directed papillæ on either side of the genital organ in the same relative position as the hind limbs which I have described in this paper. In Kükenenthal's Stage I (an embryo 32 mm. in length) the rudiments are best developed and are ~~12~~ mm. long. In Stage II (an embryo 28 mm. long) the rudiments are somewhat less distinct, reaching a length of ~~9~~ 0.8 mm. In Stage III (an embryo 30 mm. long) the hind-limb rudiments have still more decreased in size and appear as minute papillæ.

Kükenenthal has also discovered hind-limb rudiments in embryos of *Phocæna communis* and *P. dalli*, and Guldberg has recorded them in embryos of *Lagenorhynchus acutus* and *Phocæna communis*.

Kükenenthal states that the hind-limb rudiments are found in later embryonic stages of the *Mystacoceti* than in the *Odontoceti* and concludes that in the evolution of cetaceans the hind limbs lost their functional character in the *Odontoceti* earlier than in the *Mystacoceti*.

Since Kükenenthal's and Guldberg's researches have shown that external hind-limb rudiments are still present in some cases in embryonic life, it is by no means impossible that, these vestigial organs should continue their growth and persist until the adult stage. I believe that

¹Jenaische Zeitschrift für Naturwissenschaft, LI, 1914, pp. 49-52.

that is exactly what has occurred in the specimen which I have described above, and that we are confronted with a clear case of partial reversion to a primitive quadripedal condition.

The limbs, according to the statements of the whalers, were symmetrical; they are in the exact position in which the hind-limb rudiments have been found in embryonic *Megaptera*; there are strong indications that the cartilaginous femur was attached to the pelvic elements; they are homologous in many respects to the flippers, or fore limbs, and, were this a teratological case, it is doubtful if these homologies would exist.

Unwilling as are many evolutionists to accept reported cases of reversion, I can see no other explanation for the facts presented here. That this condition is extremely rare must certainly be true for, so far as I am aware, this is the only recorded case among cetaceans. The presence of rudimentary hind limbs would almost certainly attract the attention of whalers under any condition and eventually be reported to a scientific institution, as was done in the case under consideration. Although hundreds of thousands of whales have been killed, especially in the last fifty years since the beginning of shore-whaling, no other instance has been reported. We are greatly indebted to Mr. Ruck and Mr. Lawson for their quick appreciation of the importance of their discovery and I wish again to express my thanks to Mr. Kermode for giving me the privilege of describing it.

AMERICAN MUSEUM NOVITATES

Number 10

June 15, 1921

56.9,61 M (1183:7)

FIRST APPEARANCE OF THE TRUE MASTODON IN AMERICA

BY HENRY FAIRFIELD OSBORN

The geologic history of the *Mastodon* is obscure and the geographic distribution uncertain because of its forest-living habits, but recently great progress has been made in tracing the history of this animal in America, especially through the studies and collections by Matthew and Cook¹ and Sinclair,² through Schlesinger's description of the Miocene proboscideans of Europe,³ and finally through Matsumoto's restudy of the proboscideans of the Oligocene Fayûm deposits of northern Egypt.⁴ From the latter it appears probable that the true *Mastodon* sprang from the genus *Palæomastodon* of northern Africa, while the bunomastodonts (*Trilophodon angustidens* phylum) sprang from the genus *Phiomia* of the same deposits. From the American Museum collections hitherto undescribed, Matsumoto has positively separated these genera and the species associated with them, which have been confused ever since the original descriptions by Andrews of *Palæomastodon*, in 1901, and of *Phiomia*, in 1902.

Matsumoto shows that the name *Palæomastodon* applies only to the lophodont type of *P. beadnelli* on which it was founded. This animal has a much broader skull than its contemporary *Phiomia*. These two animals were profoundly distinct, but, until the remainder of the skull and cutting teeth of *P. beadnelli* is known, we cannot be sure that this animal is directly ancestral to *Mastodon*.

MIOCENE AND PLIOCENE MASTODONS IN EUROPE

To the *M. tapiroides* of Cuvier, Schlesinger has added a series of forms which are more or less truly lophodont from the Miocene of France and of Austria, the relations of certain of which to *Mastodon* are, in our

¹'A Pliocene Fauna from Western Nebraska.' By W. D. Matthew and Harold J. Cook, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, Art. 27, pp. 361-414.

²'Contributions to the Snake Creek Fauna.' By W. D. Matthew, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, Art. 7, pp. 183-229.

³'Additions to the Fauna of the Lower Pliocene Snake Creek Beds (Results of the Princeton University 1914 Expedition to Nebraska).' By William J. Sinclair, 1915, Proc. Amer. Phil. Soc., Phila., LIV, No. 217, May-July, pp. 73-95.

⁴'Die Mastodonten des K. K. Naturhistorischen Hofmuseums.' By Günther Schlesinger, 1917, Denksch. K. K. Naturhist. Hofmuseums, I, Geol.-Paläontol., Reihe 1, pp. 1-230.

⁵In preparation for the American Museum Bulletin by Dr. Hikoshichiro Matsumoto.

opinion, doubtful. There cannot be the least doubt, however, as to the affinity of the grinding teeth found in the Lower Pliocene of Hungary, to which Schlesinger applies the name *M. tapiroides americanus*. These teeth are reproduced herewith (Fig. 1, *D, D1*) from unpublished photographs, kindly forwarded by the author, to the same scale with corresponding grinders (*A, A1, A2, A3*) from the Lower Pliocene, Snake Creek formation, of western Nebraska, also with lower teeth (*B*) from the Middle Pliocene, Thousand Creek, Nevada, and with (*C*) the posterior lower molar of *M. americanus* from the American Pleistocene.

***Mastodon tapiroides americanus* Schlesinger**

The upper and lower grinders from the Lower Pliocene, Tasnád, Usztató Kom., Hungary, embrace a third left superior molar (Fig. 1, *D1*, see Pl. XIII, fig. 5, Schlesinger), also two left inferior molars, m_2 - m_3 (Fig. 1, *D*, see Pl. XIV, fig. 1, Schlesinger). The linear measurement of the crowns agrees closely with that of the Pleistocene *M. americanus*, but the vertical measurement is apparently less, i.e., less hypsodont. This indicates that already in the Lower Pliocene the mastodonts had attained the massive proportions of their Pleistocene descendants. The lophs are similarly composed and show no trace of a trefoil ridge. There is nothing to debar these Lower Pliocene mastodonts of Hungary from the true ancestral line of our Pleistocene *Mastodon*.

THE AMERICAN PLIOCENE MASTODONS

During the summer of 1908 the American Museum party, under Dr. W. D. Matthew, first collected in the Snake Creek of western Nebraska a fauna subsequently determined as of Lower Pliocene age (Matthew and Cook, 1909, p. 361). The first proboscidean found appeared not to be referable to the true *Mastodon* (p. 367) but rather to the bunomastodont group. Subsequently, in 1918, several distinctive specimens were found in the same beds which may now be named as the type and paratypes of a new species of *Mastodon* (*Mastodon matthewi*), in honor of Dr. W. D. Matthew, the author who first described this interesting fauna. In 1918¹ this fauna was divided by Matthew into two life zones, an older zone of Upper Miocene age, in which *Merychippus* was abundant, and a more recent zone containing *Protohippus*, *Hipparion*, and *Pliohippus* (cf. *mirabilis*) of Lower Pliocene age. The latter zone may be known as

¹Osborn, H. F., 1918, 'Equidae of the Oligocene, Miocene, and Pliocene of North America. Iconographic Type Revision.' Mem. Amer. Mus. Nat. Hist., N.S., II, Pt. 1, p. 34, "Preliminary Key to the Geologic Distribution of the Principal Species of Equidae."

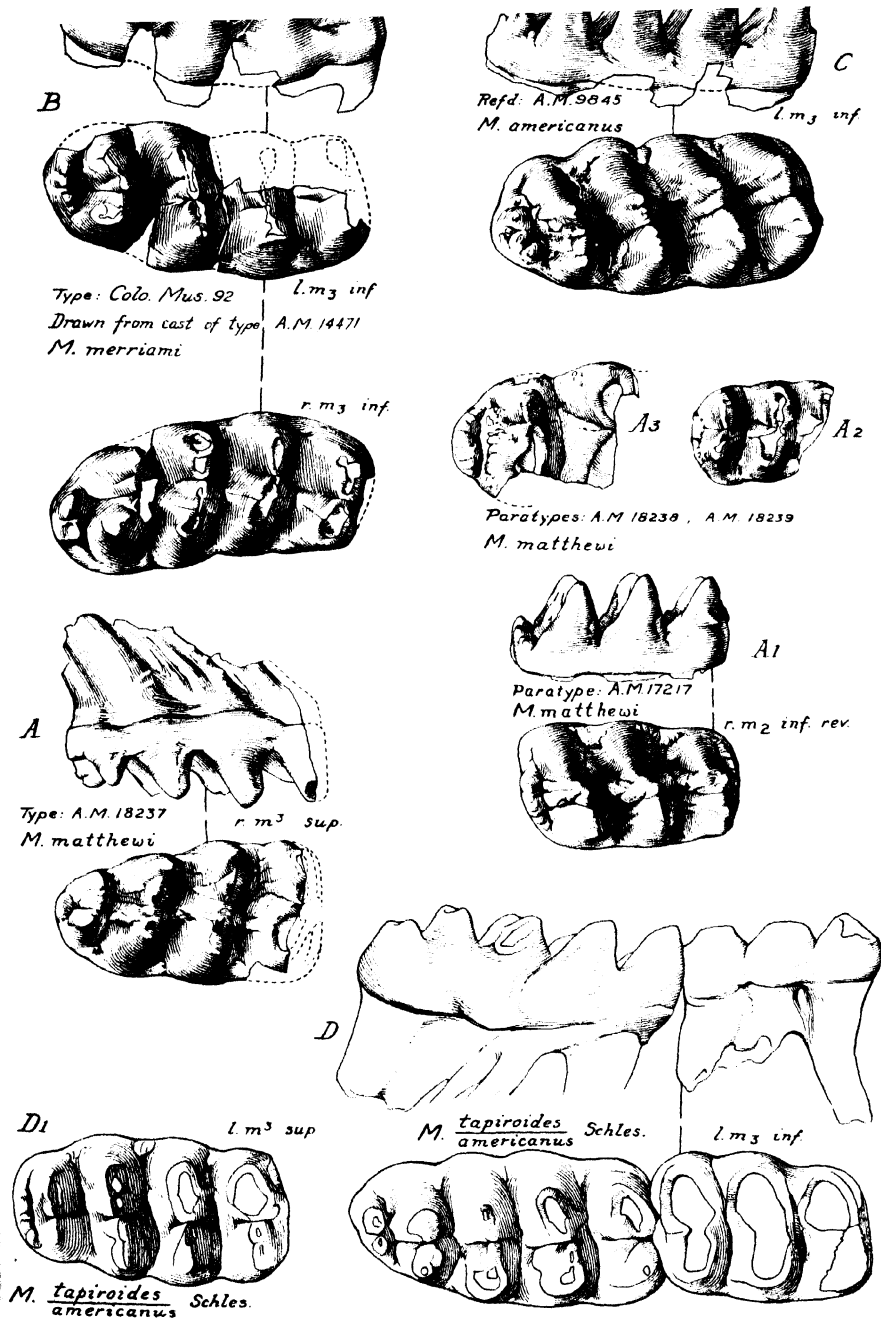


Fig. 1. **D** and **D₁**. Inferior molars referred to *Mastodon tapiroides americanus*, from the Lower Pliocene of Hungary. Reproduced through the courtesy of Dr. Günther Schlessinger.
A, **A₁**, **A₂**, and **A₃**. Type and paratypes of *Mastodon matthewi* Osborn, from the Lower Pliocene of Nebraska.

Snake Creek B or *Procamelus-Hipparion* Zone, similar to that of Fort Niobrara Nebraska, of Little White River South Dakota, of Clarendon Texas, and of the Santa Fé Marls B New Mexico. From his collection of 1914, Sinclair also reported (1915, p. 84, Fig. 9) a left last lower molar attributed to ?*Mastodon* species, collecting locality 1000A. It is probably in this true early Pliocene of North America, broadly equivalent to Pikermi-Eppelsheim of Europe, that *M. matthewi*, the first true *Mastodon* to reach America, occurs. In his second paper, Matthew (1918, p. 199) confirms Sinclair's division of the Snake Creek proboscideans into two types and selects for the zygalophodont type, allied presumably to *M. americanus*, the generic name *Zygalophodon* Vacek, 1877, type *M. tapiroides* Cuvier.

Of more recent age, probably Middle Pliocene, is the type of *Mastodon merriami* from Thousand Creek, Humboldt County, Nevada, discovered by Mr. George D. Mathewson in digging one of the excavations along the opal outcrop on a precipitous hill about 500 feet above the level of Thousand Creek and between the main forks of the creek, as described by the geologist, Richard C. Hills.¹ The formation consists of a more or less stratified volcanic ash containing much opalized wood. The type specimens include several bone fragments, portions of the two upper tusks, and parts of the upper molars, in addition to the well-preserved two lower molars here figured as the type. A very important character is the presence of broad enamel bands on the upper tusks (Fig. 2, C, D, E), which are perhaps similar to the enamel bands observed by Schlesinger in the true Miocene and Pliocene mastodons of Hungary. The Thousand Creek fauna of Nevada is regarded by Merriam as of Middle Pliocene age. It is deemed by Osborn as belonging to the *Ilinoeceras-Pliohippus* Zone, to which is assigned the temporary number 16 (Osborn, 1918, p. 34).

***Mastodon matthewi*, new species**

TYPE: the right third superior molar, Amer. Mus. 18237. PARATYPES: the right second inferior molar (unworn), Amer. Mus. 17217; the posterior portion of a right third inferior molar (more worn), Amer. Mus. 18238, also of a right second inferior molar, Amer. Mus. 18239. The type and paratypes probably belong to four different individuals. Collected by the American Museum expeditions of 1916 and 1918 under

¹The writer is indebted to Dr. Richard C. Hills for a letter, March 9, 1921, which contains a full account of his discovery of this interesting type.

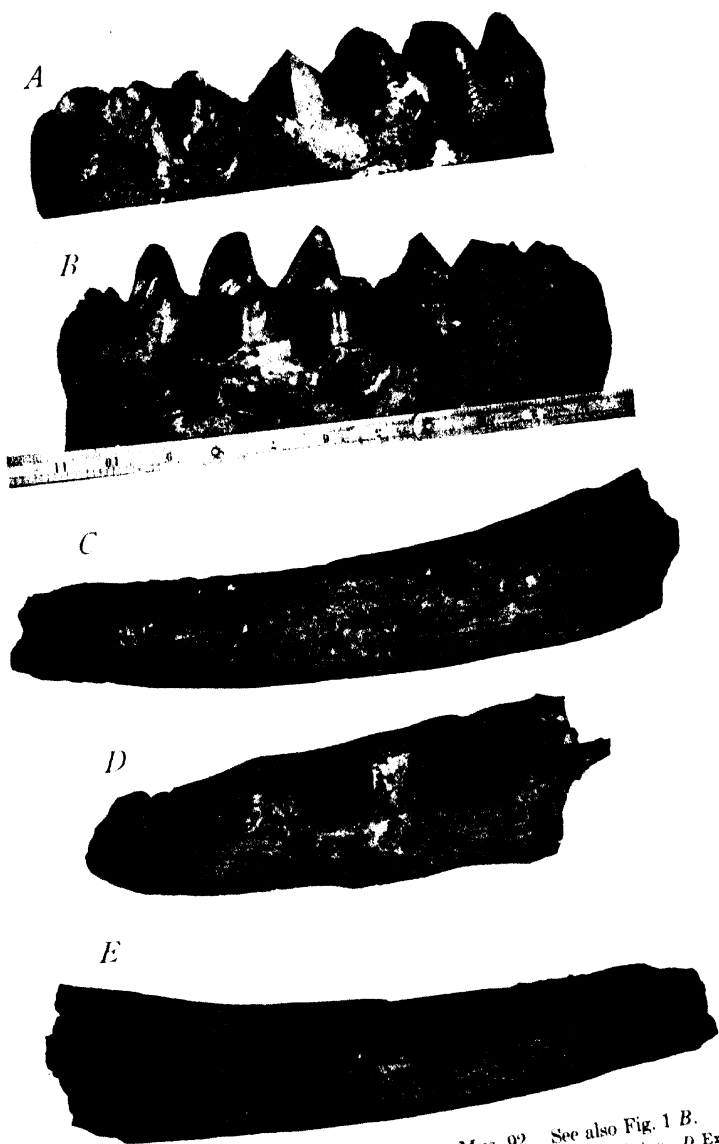


Fig. 2. Type of *Mastodon merriami*, Colo. Mus. 92. See also Fig. 1 B.
Two lower grinders: A. Internal view. B. External view. Tusk: C. Lateral view. D. External
view. E. External view of opposite tusk. Inch scale as indicated.

Mr. Albert Thomson. The type and Nos. 18238 and 18239 are from the Snake Creek B level (*Procamelus-Hipparion* Zone) of Sioux County, Nebraska; the level of No. 17217 is not recorded.

The type (Fig. 1, A) is distinguished by the rapid narrowing of the posterior half of the crown of the third upper molar, including the third and fourth crests; the fourth crest is extremely narrow and bilobed; the rudimentary fifth crest consists of a single cusp. In these features *M. matthewi* is more primitive than the corresponding tooth of *M. tapiroides americanus* (Fig. 1, D1) of the Lower Pliocene of Hungary. The association of the lower molars, Amer. Mus. 17217, 18238, 18239, as paratypes is provisional, because the Snake Creek deposition extended over a long period of time and may represent more than two life zones. Of these teeth, m_2 presents three unworn pointed crests with the rudiments of a trefoil (Fig. 1, A1); in a second molar (Fig. 1, A2) the trefoil is less apparent; in the third lower molar (Fig. 1, A3) it is not apparent at all. In the latter tooth, which is probably the posterior half of a third lower molar of the right side, the third and fourth crests are partly preserved; crest five is represented by a broad tuberculate talon.

***Mastodon merriami*, new species**

TYPE: Colo. Mus. 92, found in 1909 in the Thousand Creek formation, Humboldt County, Nevada, includes two left inferior molars (Fig. 2, A, B); cast, Amer. Mus. 14471, also portions of two upper tusks.

The contours of these grinding teeth, as seen from above (Fig. 1, B), are convexo- (inner side) concave (outer side); the first crest is relatively narrow; the second, third, and fourth crests are relatively broad; the rudimentary fifth crest is little if any more advanced than in *M. matthewi*; crests two to four exhibit rudimentary intermediate cones and the spurs of a trefoil. The presence of an enamel band on the tusks and the somewhat more brachyodont character of the grinding teeth separate this stage from the *M. americanus* (Fig. 1, C) of the Pleistocene. This species is dedicated to Professor John C. Merriam, in recognition of his pioneer work in describing the fauna of Thousand Creek.

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55.1,72(76.9)

THE GEOLOGY ABOUT MILLS SPRINGS, MONTICELLO QUADRANGLE, KENTUCKY

BY EDWARD J. FOYLES

The Monticello Quadrangle of the U. S. Geol. Survey is bounded by the meridians $84^{\circ} 45' W.$ and $85^{\circ} W.$ and by the parallels $36^{\circ} 45' N.$ and $37^{\circ} N.$ The northeast quarter of this district may be reached by automobile from Burnside, a station on the main railroad between Cincinnati and Cumberland Falls, Ky. Sections were made and fossils collected within the forty-nine square miles of the area. During the three weeks which were spent in studying the stratified rocks enough data were collected to give a comprehensive idea of the physiography, structure, and historical geology of the region.

The field work was done under the direction of Professor E. C. Case of the University of Michigan from the summer camp at Mill Springs. The writer is under deep obligations to Dr. Chester A. Reeds of The American Museum of Natural History, at whose suggestion this study was begun and who gave helpful advice and assistance in the writing of the paper. Negotiations for doing the field work and publication were conducted by Dr. E. O. Hovey. Acknowledgements are also extended to Mr. Charles Butts of the United States Geological Survey for information concerning the stratigraphy of an area nine miles to the southwest of Mill Springs.

PHYSIOGRAPHY

The area possesses the nature of a late mature to old plain on stratified rocks, slightly uplifted and moderately dissected. The Cumberland River flows generally from east to west through several prominently incised meanders (Fig. 1). The relief is striking, the highest hills being more than seven hundred feet above the Cumberland River. These hills present beautiful undulating patches of woods and open glades. At their bases broad areas of upland appear dotted with farms. The river flats or "bottoms" are composed in large part of alluvium which furnishes, when cleared of timber, rich soil for farming. The shifting of the channel in meandering streams to the outside of the bend has left steep

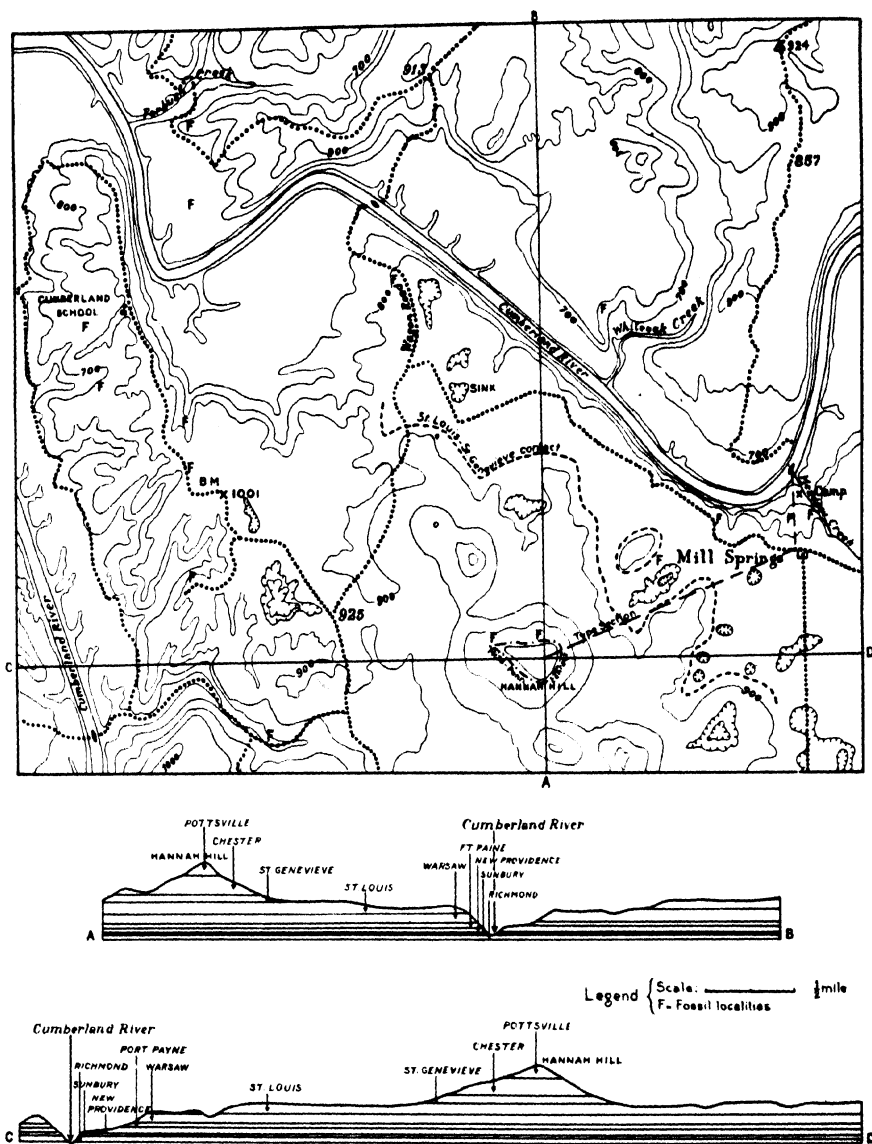


Fig. 1. Sketch Map of the northeast quarter of the Monticello Quadrangle, Wayne County, Kentucky, with profiles along the lines A-B and C-D.

Culture and Topography from U. S. Geol. Surv., Monticello Sheet. Profiles and Geology by E. J. Foyles.

cliffs along the Cumberland and small creeks. This natural phenomenon has interfered with the establishment of good lines of communication along the stream courses and has obliged the settlers to live in more or less isolated communities.

Where the Cumberland River crosses the Monticello Quadrangle it presents the characteristics of a rejuvenated stream flowing on nearly horizontal strata. Three cycles of erosion (Fig. 2) are represented in the area. The top of Hoozer Hill and other outlying knobs are the manifestation of the oldest cycle. The flat upland is representative of the second cycle. The narrow canyons and intervening level stretches along the Cumberland River represent the third cycle.



Fig. 2. Lock at Palace, Cumberland River. In the background may be seen the first, second, and third cycles of erosion.

This area exhibits not only surface but also underground drainage in a limestone plateau where the climate is moist and the strata are nearly horizontal. The sinks form a special feature of the region. Some of these depressions are over 100 feet deep. Short creeks flow into several of them and disappear, indicating that their waters pass through underground channels and issue at the surface elsewhere in the form of springs. Some of these sinks may have been produced by the collapse of the roofs of caves. The field evidence would seem to indicate that the subterranean watercourses were developed, in the main, before the third cycle of erosion or post-Tertiary trenching of the Cumberland valley took place.

STRUCTURAL GEOLOGY

The rocks of the region are nearly horizontal, a fact which may be seen by observing the sections along the lines A-B or C-D on the map (Fig. 1). The only departures from the level character of the strata are caused by low domes and basins. The mouth of Forbush Creek is the center of a dome whose strata rise high enough to expose the Ordovician rocks above the surface of the Cumberland River. Mill Springs is in the center of a broad basin from which the strata rise toward the north, west, and south. The dip of the beds between Forbush Creek and Mill Springs is 15 feet per mile southeast. A greater dip is exposed at the mouth of Cub Creek.

The main section, upon which this report is based, was run from the ferry below the Camp up the steep slope of the hill to Mill Springs and thence to the top of Hannah Hill, a mile and one-half distant to the southwest. This section is shown by a dashed line on the map.

Two disconformities were observed. The first is demonstrated by a mass of decomposed material between the Ordovician and Mississippian beds at the mouth of Forbush Creek. The second, which is between the Warsaw and St. Louis formations, may be seen at Mill Springs where the hard gray limestone of the St. Louis rests on the shale at the top of the Warsaw. An unconformity (Fig. 4) was observed in the Warsaw beds near Mill Springs. The red residual soil at Mill Springs is interpreted as being the natural product of weathering of the St. Louis limestone.

STRATIGRAPHIC GEOLOGY

This area possesses many favorable outcrops for the study of its stratigraphy. Shinbone Cliff on the Cumberland River is one of the finest and largest. Plenty of exposures and some fossils are to be found along the smaller streams. In the deforested uplands rounded boulders appear in the fields and ledges along the roads, while on the slopes of the hills are rocks which have been loosened by frost action. Most of the hills rising above the uplands are densely covered with trees and soil, yet enough outcrops are available for a successful study of the geology.

ORDOVICIAN

RICHMOND BEDS.—At the mouth of Cub Creek the Richmond beds of Ordovician age, some fifty-six feet thick, are represented by thin layers of gray limestone which represent the Arnheim subdivision of this period. The rocks contain sun-cracks, ripple-marks, intraformational mud conglomerate, and miniature cross-bedding, criteria which indicate

that these beds were deposited in shallow water followed by occasional emergence. Aside from dolomite, sphalerite, and calcite crystals in geodes, a few fossils (*Columnaria vacua* Foerste and *Platystrophia cyphacnardi* Foerste) were found at the base of these beds. The 23.5 feet of covered rocks, 12 feet of finely-crystalline gray limestone, and 5 feet of decomposed material underlying the Sunbury black shale near the mouth of Forbush Creek may represent the Saluda horizon, as suggested by Mr. Butts.

MISSISSIPPIAN

At the University of Michigan Geological Camp in the vicinity of Mill Springs, the Mississippian is by far the most extensive and fossiliferous group of rocks, having a total thickness of more than 600 feet. Beginning at the base the formations are the Sunbury shale, the New Providence shale, the Fort Payne shales, cherts and limestones, the Warsaw shales and limestones, the St. Louis limestone, the St. Genevieve colitic limestone, and the Chester limestones.

SUNBURY SHALE.—One-quarter mile up Forbush Creek occurs an exposure of the black carbonaceous Sunbury shale superimposed disconformably on 5 feet of decomposed Saluda material, the highest Richmond exposed in the area. Although the total known thickness of the Sunbury is 28 feet, only 5 feet appear on Forbush Creek. A careful search for fossils revealed *Ctenacanthus* species, *Pisces* indeterminable, and *Phillipsia* species. It is the teeth of *Ctenacanthus*, a shark, which made it possible to recognize the Sunbury at this place.

NEW PROVIDENCE FORMATION.—Directly overlying the Sunbury on Forbush Creek is the New Providence formation which consists of 29 feet of greenish-gray crumbly shale containing phosphatic concretions the size of marbles and also carbonate of iron concretions. This formation yields the fossils *Cyathaxonia cynodon* Rafinesque and Clifford, *Cliothyridina glenparkensis* Weller, *Platycrinus sculptus* Hall, and *Phillipsia* species. The crinoid *Platycrinus sculptus* Hall is represented in great abundance by its stem-plates which are locally known as "fossil buttons" and "Indian beads."

FORT PAYNE FORMATION.—On the road leading from the Camp to Mill Springs the Fort Payne or Keokuk is exposed vertically for 97 feet at a low-water stage of the Cumberland River. In general, this formation is composed of a stiff dark shale, chert bands, and lenses of coarse, gray and sometimes crinoidal limestone (Fig. 3). The character of these rocks varies greatly in short distances. In the immediate vicinity of the camp

22 feet of gray, nodular, impure shale are exposed at the base, followed by 11 feet of limestone with solution cavities, then 25.5 feet of gray geodic shale. On top of this appear a five and one-half foot lens of gray compact limestone, 21 feet of gray shale with two six-inch chert layers near the top, and 12 feet of gray limestone containing the fossils *Chonetes* species, *Spirifer biplicoides* Weller, *Productus magnus* Meek and Worthen, and *Rhynchopora cooperensis* Shumard.

WARSAW FORMATION.—In the vicinity of Mill Springs the Warsaw, which is well exposed for 92 feet, is divided into six zones. The basal member is composed of 16.5 feet of gray geodic shale containing carbona-

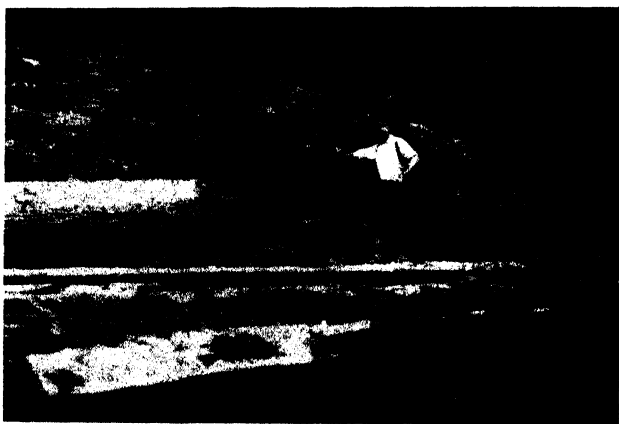


Fig. 3. Outcrop of the Fort Payne Formation, Mississippian, on Meadow Creek, showing limestone lens above hammer and flaggy shale below.

ceous concretions. The next zone consists of 18 feet of brownish-yellow to gray compact limestone. On this lie 16.5 feet of decomposed gray shale which yielded the fossils *Pustula biserialis* Hall and *Chonetes illinoisensis* (Worthen). At the top of this bed, on the road between the camp and Mill Springs, appears a local unconformity (Fig. 4). Overlying this are 22.5 feet of yellow, impure limestone containing *Triplophylum* species. Then follow 13 feet of limestone in which are found the fossils *Spirifer bifurcatus* Hall and *Reticularia pseudolineata* Hall. The last and uppermost member is a gray fissile shale 5.5 feet thick in which no fossils were found.

ST. LOUIS FORMATION.—Lying disconformably on the Warsaw formation is the St. Louis, a hard gray limestone containing the fossils

Lithostrotion basaltiforme Owen, *Lithostrotion proliferum* Hall, *Spirifer bifurcatus* Hall, *Mesoblastus glaber* Meek and Worthen, and *Nautilus* species. Although 34.5 feet of the St. Louis are exposed at Mill Springs, it is probable that the overlying covered rock, 80 feet in thickness, is also a part of the St. Louis. Caverns, sink holes and underground drainage characterize this formation. Due to the soil cover, the contact with the overlying St. Genevieve was not observed. The probable line of differentiation is shown on the map (Fig. 1).

ST. GENEVIEVE FORMATION.—Superimposed on the St. Louis at Hannah Hill 1.5 miles southwest of Mill Springs is the Fredonia forma-



Fig. 4. Local unconformity in the Warsaw beds, Mississippian, on the road between Mill Springs and the University Camp.

tion of the St. Genevieve. Although no contact between the St. Genevieve and the St. Louis was to be seen, it is estimated that the St. Genevieve is 60 feet thick. It is composed of oölitic limestone containing the fossils *Girtyella indianensis* Girty, *Eumetria verneuilliana* Hall and *Lithostrotion harmodites* Edwards and Haime.

CHESTER SERIES.—On the slope of Hannah Hill the Chester is represented by the Gasper and Glen Dean formations totalling a thickness of 146 feet. The Cypress and Golconda formations of this series were not observed. Due to soil cover, the upper and lower contacts of the Gasper, which is a fine-grained crystalline limestone, are difficult to determine. The Glen Dean consists of dark coarsely-crystalline limestone. These formations yielded the fossils *Productus ovatus* Hall,

TABLE OF ROCKS AND FOSSILS OF THE NORTHEAST QUARTER OF THE MONTICELLO QUADRANGLE,
WAYNE COUNTY, KENTUCKY

Group	System	Series	Stage	Sub-stage	Characteristics of Rock	Fossils	Thickness in feet
Paleozoic	Pennsylvanian			Pottsville	Yellowish-brown sandstone. Bituminous Pockets		130
		Chester		Glen Dean	Coarse Limestone	<i>Eumetria vera</i> Hall <i>Diaphragmus elegans</i> Norwood and Pratt	146±
				Gasper	Finely-crystalline limestone	<i>Productus oratus</i> Hall	
	Mississippian		St. Genevieve	Fredonia	Oolitic Limestone	<i>Lithostroton harmodites</i> Edwards and Haime <i>Eumetria verneuilliana</i> Hall <i>Girgella indianensis</i> Girty	60±
		Mammoth Cave	St. Louis	Salem?	Hard gray limestone. Cherty veins	<i>Lithostroton basaltiforme</i> Owen <i>Lithostroton proliferum</i> Hall <i>Spirifer bifurcatus</i> Hall <i>Nautilus</i> species <i>Mesoblastus glaber</i> Meek and Worthen	34.5+
					Gray fissile shale Grades into limestone		5.5
					Limestone	<i>Reticularia pseudolineata</i> Hall <i>Spirifer bifurcatus</i> Hall	13
			Warsaw		Yellow impure limestone. Local unconformity	<i>Triplophyllum</i> species	22.5
					Incompact gray shale with brown clay	<i>Chonetes illinoensis</i> Worthen <i>Pustula biseriatus</i> Hall	16.5
					Brownish-yellow to gray compact limestone		18
					Gray geodic shale Carbonaceous concretions		16.5

Waverly	Ft. Payne	Gray limestone Weathers to a rough white	<i>Choneles</i> species. <i>Productus magnus</i> Meek and Worthen <i>Rhynchopora cooperensis</i> Shumard <i>Spirifer bryticoides</i> Weller	12
		Gray shale merges into limestone. Two six-inch chert layers at top		21
		Gray compact limestone lens		5.5
		Gray geodic shale		25.5
		Limestone. Solution cavities in bed of Meadow Creek		11
	Cuyahoga	Gray nodular impure shale. Cumberland River	<i>Platycrinus</i> species	22
		Greenish-gray crumbly shale Phosphate of lime and carbonate of iron concretions	<i>Cyathozonia cynodon</i> Rafinesque and Clifford <i>Clothyrina glenparkensis</i> Weller <i>Phillipsia</i> species <i>Platycrinus sculptus</i> Hall	29
		Black Carbonaceous shale	<i>Phillipsia</i> species <i>Ctenocanthus</i> species Fishes indeterminate	5
		Decomposed material		5
		Finely-crystalline gray limestone		12
Ordovician	Richmond	Forbush Creek		23.5
		Thin layers of gray limestone Sun-cracks Ripple-marks Intraformational mud conglomerate Miniature cross-bedding Dolomite, calcite and sphaerite in geodes	<i>Columnaria vacua</i> Foerste <i>Platystrophia cypha-conradi</i> Foerste	56

Diaphragmus elegans Norwood and Pratten and *Eumetria vera* Hall. *Archimedes latus* Hall and *Prismopora serrulata* Ulrich are diagnostic fossils of the Glen Dean.

PENNSYLVANIAN

POTTSVILLE FORMATION.—Succeeding the Glen Dean is the Pottsville, which consists of a medium-grained yellowish-brown sandstone. On the south side of Hannah Hill there is a bituminous pocket about 8 feet in diameter from which fuel has been dug. This formation, which is 130 feet thick, contains no fossils and caps Hannah Hill.

SUMMARY

The order of superposition, character, thickness, and names of the fossils of each of the beds which have been discussed are summarized in the preceding table.

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AMERICAN MUSEUM NOVITATES

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59.51,22 S (7)

NOTES ON NORTH AMERICAN BLOOD FLUKES¹

BY HORACE W. STUNKARD

The first North American blood flukes discovered by the writer were found in 1913, while he was a graduate student at the University of Illinois. In the autumn of that year an extensive parasitological examination of turtles was begun. Shipments of various species of turtles were obtained for this work from collectors in Havana, Illinois; Walker, Iowa; Newton, Texas; and Raleigh, North Carolina. On November 5, 1913, in the washings of the intestine of *Pseudemys elegans* collected near Havana, Illinois, a trematode was discovered which attracted attention by its peculiar and unusual movements. On November 18, 1913, an additional specimen of this particular trematode was found in the œsophagus of another specimen of *P. elegans* caught near Havana, Illinois. On December 15, 1913, a similar trematode was removed from the trachea of *Malacoclemmys lescurii* collected near Newton, Texas. The two specimens removed from *P. elegans* were stained and mounted *in toto*, and that taken from *M. lescurii* was cut in cross-sections. No other specimens were found at that time. The following summer turtles were collected in Iowa and Illinois, and in the autumn a second shipment was received from Raleigh, North Carolina. On examination of this material, the peculiar trematode was again encountered and its true nature discovered. On April 10, 1915, three specimens were removed from the heart and six from the large arteries of *Pseudemys scripta* collected near Raleigh, N. C. During the spring of 1915, blood flukes were removed from the heart and arteries of *Chrysemys marginata* collected in Iowa, Illinois, Indiana, and Ohio; from *Chelydra serpentina* collected in Iowa, Illinois, Ohio, Louisiana, and Texas; and from *Pseudemys elegans* and *Malacoclemmys geographicus* collected in Louisiana. In the fall of 1916, examinations were continued at New York University and blood flukes recovered from the heart and larger arteries of *Chrysemys picta* and *Chelydra serpentina* collected in New York, New Jersey, and North Carolina; and also from *Chelopus guttatus* and *Cistudo carolina* collected at various points in New York and New Jersey. This material obviously belonged to a common genus, but it included forms so different that it was impossible to refer them to the same species.

¹Contribution from the Biological Laboratory, New York University.

The study was interrupted from the spring of 1917 to that of 1919, during which time the writer was in the U. S. army in France. With the resumption of scientific work on release from military service, I found that in a paper dated July, 1918, Dr. G. A. MacCallum had published a description of a trematode from the intestine of *Chelopus insculptus*, so similar to the blood flukes I had collected that it appeared they must be the same. MacCallum named this parasite *Spirorchis*, but omitted the specific name. The blood flukes and the form described by MacCallum are monostomes of almost the same size and shape; they agree in position and character of oral sucker, position and extent of intestinal caeca, position and extent of vitellaria, vitelline ducts and receptacle, position and shape of ovary, oviduct and uterus, position, character and extent of testes, shape and location of seminal vesicle and vas deferens, as well as the position of the excretory pore. They are alike in character of the intestinal contents, which led MacCallum to describe the form as a hæmatophagic trematode. The only points of difference are found in the statement of MacCallum that in *Spirorchis* a pharynx is present and that the genital pore is median near the posterior end of the body, while in the blood flukes a pharynx is absent and the genital pore is lateral, slightly posterior to the level of the ovary.

Conferring with Dr. MacCallum, I learned that the description was made from specimens mounted *in toto*, but unfortunately the slide could not be found. Dr. MacCallum examined several of my slides and noted the similarity between these worms and that described by him, but was not certain that they were the same. In correspondence with Professor Henry B. Ward, of the University of Illinois, under whose direction my graduate work was done and who was familiar with my studies on blood flukes, I wrote on February 2, 1920, that I was certain that the form described by MacCallum as *Spirorchis* is not from the intestine but from the mesenteric vessels and that it belongs to the group of blood flukes, and asked whether in his opinion I should describe the blood flukes as a new genus or assign them to the genus *Spirorchis*. Subsequently, I wrote Dr. C. W. Stiles of the International Commission on Nomenclature, stating the case and asking for information as to the correct method of procedure in determining a name for the blood flukes. In his reply, dated March 1, 1920, Dr. Stiles gave as his opinion that the name *Spirorchis* would be established by "finding the original slide or by collecting material from the type host and type locality and redescribing the genus." "If it proves that your material is identical with *Spirorchis*, I believe that *Spirorchis* would take priority." "According to the rulings

of the International Commission, a generic name may be valid even though no specific name is published with it. The first specific name that is published after the generic name becomes the type of the genus."

In the Journal of Parasitology, March 21, 1921, Ward published certain observations and a description of 'A New Blood Fluke from Turtles,' giving to this parasite the name, *Proparorchis artericola*. He reports that the fluke has been found in several distinct species of turtles and widely separated localities, and records it from *Pseudemys elegans* at Havana, Illinois; *Malacoclemmys lescurei* from Newton, Texas; *Pseudemys scripta* from Raleigh, North Carolina; and *Chrysemys marginata* from Fairport, Iowa. He adds, "The data in my possession are not all referable to the single species which has just been described. In details of structure, in regard to the eggs, in the location in the host in which they have been observed, and in some other details, certain specimens differ so distinctly that I can not at present include them under the same heading." Referring to MacCallum's paper, Ward accepted his diagnosis as it stands, assigned to the form the specific name *innominata*, and included the genera *Spirorchis* and *Proparorchis* as members of a new subfamily Proparorchinae. He removed the genus *Hapalotrema* Looss 1899, from the subfamily Liolopinae Odhner 1912, and included it with the subfamily Proparorchinae in a new family, Proparorchidae.

Though engaged for several years in the study of blood flukes of turtles, publication has been delayed because of lack of certainty regarding two points; first, the question of nomenclature and the relation of the blood flukes to the genus *Spirorchis*, and second, the difficulty of specific determination of the material at hand. The latter of these questions is still under investigation, and may not be solved until the developmental stages and life history are known; the former has now been answered. The original specimens of *Spirorchis*, to which Ward assigned the specific name *innominata*, have been found, and through the kindness of Dr. MacCallum have been loaned to me for examination. After careful study I wish to make certain corrections and additions to the description of the form. As noted previously, the only cardinal differences between the blood flukes and the description of MacCallum are the presence or absence of a pharynx, the position of the genital pore, and the location within the host. The structure described as a pharynx in *Spirorchis*, though it somewhat resembles such an organ, is in reality the œsophageal commissure of the nervous system and no pharynx is present. The œsophagus is surrounded by unicellular glands which at the posterior region are large and stain deeply. The genital pore is ventral, below the

cæcum of the left side, a short distance posterior to the level of the ovary. MacCallum traced the cirrus sac to the intestine, but was unable to follow the genital ducts to the structure he regarded as the genital pore. It is a significant fact that though MacCallum reported the parasite from the intestine, he noted that its intestinal content showed it to be a hæmatophagic trematode. As Ward pointed out, "It is not unlikely that its presence in the intestine was accidental, due to the opening of some blood vessel during the dissection." The first blood flukes found by the writer were discovered in the washings of the intestine after its dissection, and though I have not as yet been able to secure specimens of *Spirorchis* from the circulatory system of *Chelopus insculptus*, I have found eggs of blood flukes in the tissue of that species and I am still of the opinion stated over a year ago that the specimens described by MacCallum came originally from mesenteric blood vessels.

On the basis of morphological similarity, there can be no doubt that the blood flukes of turtles belong to the genus *Spirorchis*. I have specimens collected from the same hosts and the same localities as those of Ward, and which are certainly specifically identical with his material. These specimens show no generic differences from those discovered by MacCallum. The generic description of *Proparorchis* as given by Ward agrees with the corrected description of *Spirorchis*, demonstrating the identity of these forms. With the establishment of their identity, *Proparorchis* disappears as synonym. With the synonymy of *Spirorchis* and *Proparorchis* and the suppression of the latter name, the subfamily and family names Proparorchinæ and Proparorchidæ also disappear. *Spirorchis* remains then as the only known genus and type of the subfamily to which it belongs, and for which, in conformity with the rules of zoological nomenclature, I propose the name **Spirorchinæ**. I agree with Ward that *Hapalotrema* does not find a natural position in the subfamily Liolopinæ of the family Harmostomidæ, and that it must be removed from those groups. It differs from *Spirorchis* in the location of the ovarian complex and genital pore and also in the possession of an acetabulum. No existing subfamily will contain it, and it may well be considered as the type of a new subfamily, the **Hapalotreminæ**. Ward included *Hapalotrema* and the Proparorchinæ (syn. Spirorchinæ) in a new family, for which I propose the name **Spirorchidæ**.

In position of female organs and genital pore, *Spirorchis* resembles *Aporocotyle* and manifests relationship to that form. The discovery of the American blood flukes of turtles establishes a firmer basis for the conception of the unity and evolution of the blood inhabiting trematodes.

In my opinion, the Aporocotylidæ of fishes, the Spirorchidæ of turtles, and the Schistosomidæ of birds and mammals constitute a well-defined group with inherent natural relationships. The Spirorchidæ stand in an intermediate position, and the schistosomes are, I believe, derived through them from the Aporocotylidæ rather than from the Harmostomidæ as maintained by Odhner.

Specimens of *Spirorchis* collected from various species of turtles, on which these notes are based, form part of the collection of blood flukes in the Department of Lower Invertebrates of The American Museum of Natural History.

56.9 (1181:73)

NEW GENERA OF PALEOCENE MAMMALS

BY W. D. MATTHEW AND WALTER GRANGER

In the course of the revision of the Puerco and Torrejon faunas of New Mexico and the description of the more recently discovered Tiffany fauna of southwestern Colorado, several new genera were recognized which it seems advisable to place on record in advance of the full description.

MULTITUBERCULATA

Plagiaulacidæ

*Ectypodus*¹ *musculus*, new genus and species

TYPE.—No. 17373, upper jaw from the Mason pocket, Tiffany beds, Animas Co., Colorado.

TOPOTYPES.—A series of seven upper and lower jaws and many isolated teeth and jaw fragments, all from the Mason pocket.

GENERIC CHARACTERS.—Dentition: $\frac{1.1.4.2}{1.0.1.2}$. Teeth much as in *Ptilodus*, except that p^4 is of simple trenchant type instead of molariform. The crown is triangular in cross-section and there are seven tubercles on the interior cutting edge. On the outer face of the crown near its anterior border there are usually two (one in type) minute tubercles; these appear to be a rudiment of the second row of tubercles which in *Ptilodus* extends the full length of the tooth. P^1 and P^2 are tricuspid; p^3 is quadricuspid. The lower jaw (topotypes) is similar to *Ptilodus*, except that P_3 is absent.

SPECIFIC CHARACTERS.— $P^1-M^3=6.2$ mm.

Eucosmodon,² new genus

TYPE.—*Neoplagiaulax americanus* Cope, of the Puerco formation, Lower Paleocene of San Juan basin, New Mexico.

GENERIC CHARACTERS.—Agrees with the true *Neoplagiaulax*, of the Cernaysian of France, in absence of P^3 (present in *Ptilodus*), but differs from both of these genera and from *Ectypodus* in the large, compressed, fully scalpriform incisor, rootless or nearly so. The species are of considerably larger size than those of the three above-named genera.

¹ἄκρυτος = carved in relief; ὀδός = tooth; in reference to the peculiar type of sculpture of the lower premolar.

²ἑὺ = well; κοσμός = ornament; ὀδός = tooth.

MARSUPIALIA

Didelphidæ

***Peradectes*¹ *elegans*, new genus and species**

TYPE.—No. 17376, a pair of lower jaws, nearly perfect, from the Mason pocket, Tiffany beds, Colorado.

PARATYPE.—No. 17369, upper jaw with M¹⁻⁴.

GENERIC CHARACTERS.—Dentition: $\frac{1.1.3.4}{1.1.3.4}$. Upper molars tritubercular, paracone and metacone subequal, stylar cusps weak, conules rudimentary. Last upper molar transverse. Lower molars with high trigonids and deep basin heels, paraconid well developed, anterointernal; premolars simple, with high compressed protoconids and small heels on P₂₋₃. Molars increasing somewhat in size from first to third, the fourth slightly smaller with narrower heel. Canines moderately large, as in *Marmosa*. Jaw slender, with inflected angle as in opossums.

SPECIFIC CHARACTERS.—Size minute, P₁-M₄=11 mm.

About fifteen specimens of upper and lower jaws of this genus were obtained from the Mason pocket, it being, next to *Nothodectes*, the most abundant form. The generic characters separating *Peradectes* from *Peratherium* are found principally in the upper teeth.

***Thylacodon*² *pusillus*, new genus and species**

TYPE.—No. 16414, a fragment of lower jaw, with m₂₋₃, the heel of m₁ and part of alveolus of m₄, from the upper level of the Puerco formation near Ojo Alamo, San Juan basin, New Mexico. Exped. 1913.

GENERIC CHARACTERS.—Molar teeth of didelphid type, rather narrow as a whole, the trigonid relatively high, with reduced paraconid. Metaconid and protoconid high, well separated, acute, the protoconid considerably the higher. Talonid deeply basined with acute marginal cusps, the entoconid internal, hypoconulid well developed on all molars and nearly posterointernal in position (a characteristic didelphid construction), hypoconid postero-external. The high bicuspid trigonid and reduced paraconid serve to distinguish this from other didelphid genera; the tooth is also unusually narrow and the hypoconulid and entoconid more distinct than usual.

SPECIFIC CHARACTERS.—M₂₋₃=5. mm.; M₁₋₃=7.2 mm. (approx.). Size of the larger species of *Marmosa*, about a third larger than *M. chapmani*.

Represented in the collection by the type specimen only.

INSECTIVORA

Leptictidæ

***Leptacodon tener*³, new genus and species**

TYPE.—No. 17179, lower jaws with badly crushed front of skull, from the Mason pocket, Tiffany beds, Colorado.

¹πηρα = pouch; δῆκτης = biter; i. e., a carnivorous marsupial. Also suggestive of its relative *Peratherium*.

²θιλακος = pouch; δόσις = tooth, i. e., marsupial tooth.

³From λεπτός = small, delicate; ἀκμή = point; δόσις = tooth. Intended to be also suggestive of its relationship to *Leptictis* and *Diacodon*.

FAMILY CHARACTERS (Leptictidae).—Jaw long, slender with low condyle, prominent narrow angular process curving downward and backward, not inflected, coronoid process low, broad. Upper molars tritubercular, paracone and metacone subequal, external, with strong cingulum around outer base but stylar cusps rudimentary, conules minute, protocone large, subrescendent, hypocone small but prominently projecting; lower molars with short high trigonids and large basin heels; p^4 molariform except that *me* is smaller than *pa* and *pr* and *hy* smaller than in true molars. p_4 molariform, but with *pa*^d strong, projecting prominently forward, anterior premolars moderately large, compressed, simple, not crowded.

GENERIC CHARACTERS.—Trigonids lower than in *Diacodon*, paraconids distinct, molars reduced in size from first to third. Protoconid overtopping inner cusp. The least specialized in molars and premolars of any member of the Leptictinae.

SPECIFIC CHARACTERS.—Size minute, $P_2-M_3 = 7.3$ mm.

*Xenacodon*¹ *mutilatus*, new genus and species

TYPE.—No. 17407, a right ramus of the lower jaw with P_4 , M_{2-3} and alveoli of remaining teeth, from the Mason pocket, Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition $\overline{3.1.4.3}$. Incisors small, canine of moderate size, P_1 two-rooted, P_4 with large, well-separated metaconid and protoconid, rudimentary paraconid and very small heel. Molars as in *Diacodon* and *Palæolestes* with high trigonids of two principal cusps well separated, very small paraconids, large high-cusped heel with deep basin opening inward, high external hypoconid and posterior hypoconulid, entoconid smaller, posterointernal and imperfectly separated from hypoconulid. Distinguished from other genera of Leptictidae principally by the peculiar character of its P_4 .

SPECIFIC CHARACTERS.—Size of *Palæolestes puericensis* ($M_{2-3} = 7$ m.) which it resembles in general proportions. Third premolars considerably more robust; the first and second of subequal size, both being two-rooted. Premolars not spaced and only a very small space behind the canine, which is a somewhat larger tooth than in *P. puericensis*.

Represented in the collection by the type only.

*Acmeodon*² *secans*, new genus and species

TYPE.—No. 16599, a part of the lower jaw with P_2-M_2 and the root of the canine preserved. From the upper level of the Torrejon formation, Torrejon Arroyo, San Juan basin New Mexico. Exped. 1913.

GENERIC CHARACTERS.—Dentition $\overline{1.1.3.3}$. Molars of leptictid type but trigonid not so high and paraconid better developed than in *Diacodon* or *Palæolestes*. P_4 of peculiar pattern, the principal cusp (protoconid) much compressed and crested, with strong accessory cusps (paraconid, protostylid) on the anterior and posterior edges and a somewhat weaker posterointernal cusp (metaconid) connected by a prominent crest with the apex of the protoconid; also a well-developed basined talonid with acute poster-external and posterointernal cusps (hypoconid, entoconid).

¹ξένος = strange; ἀκμή = point; ὀδούς = tooth. In reference to the very peculiar p_4 , which appears at first glance to be a broken and incomplete tooth.

²ἀκμή = a crest or edge; ὀδούς = tooth.

P₃ large, simple, high, acute and compressed, with anterior postero-external and posterointernal crests, and a small, low, simple, acute heel-cusp. P₂ much smaller, simple, with anterior and posterior crests and a minute heel-cusp. Canine rather small, oval in cross-section at base. At least one small incisor is present.

SPECIFIC CHARACTERS.—P₂-M₂=19.3 mm.; M₁₋₃=10.6 mm. (approx.). A faint rudiment of anterior basal cusp on P₂ and P₃; on P₄ it is distinct; protostylid a faint rudiment on P₃; on P₄ this is a strong cusp connected by a crest with the apex of the protoconid.

In addition to this type there is a second specimen, paratype No. 16600, a jaw fragment with P₄-M₁ and alveoli of remaining molars, from the same horizon as the type, Escavada wash.

MENOTYPHIA

Plesiadapidae

*Labidolemur*¹ *soricoides*, new genus and species

TYPE.—No. 17400, lower jaws with incisors, M₁ right and left, and alveoli of remaining teeth; from Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\overline{1.0.1.3}$. Jaw short and of moderate depth; incisor greatly enlarged, semiprocumbent, considerably curved upward towards the tip, crown trihedral, with sharp, knife-like, coarsely serrate outer margin, anterior face flattened convex, root elongate. Fourth premolar much reduced, probably two-rooted, crown unknown, diastema much reduced owing to enlargement of incisor. First molar with a moderately high trigonid of two subequal cusps (protoconid and metaconid) well separated, and a low ledge-like paraconid appressed to anterior margin; large rounded basin heel. Third molar with elongated heel. Coronoid process low, narrow, projecting strongly backward, angle flat and of moderate width, with narrow backward projection at tip. Mental foramen below anterior edge of M₂.

SPECIFIC CHARACTERS.—M₁₋₃=5.7 mm. (approx.); length of incisor crown (lingual side)=6.7 mm.

This form is close to *Phenacolemur* of the Wasatch beds of Wyoming, but is distinguished from it by the apparently greatly reduced premolar. In *Phenacolemur* this is a large robust tooth, exceeding in size the first molar. It is possible that *Labidolemur* is the lower dentition of *Ignacius* (*infra*) but there are evidently two forms of small plesiadapids in the Tiffany beds as indicated by lower incisor teeth, one as in the present genus and the other with a much simpler, laterally-compressed and straighter crown.

Aside from the type this new form is represented in the collection from the Tiffany beds by a lower incisor, No. 17402, and, somewhat doubtfully, by two other specimens, Nos. 17401, 17405, in each of which

¹*Labls* = pincers and *Lemur*.

the last lower molar is preserved. This tooth shows the peculiarly broad elongated talonid and is structurally similar to that in *Phenacolemur*, but compared with this latter genus both *Labidolemur* and *Ignacius* are minute.

? *Plesiadapidae*

*Ignacius*¹ *frugivorus*, new genus and species

TYPE.—No. 17368, upper jaw with C, P⁴-M² and alveoli of remaining cheek teeth. From the Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\frac{1.1.2.3}{2.1.2.3}$. Canine small, simple, double-rooted, pointed. P³ two-rooted, p⁴ nearly as large as m¹, submolariform, metacone much smaller than paracone, and no crest connecting metacone with protocone, otherwise this tooth is similar to the true molars. Molars with subequal outer cusps, no external styles, minute protoconules, a broad sloping shelf occupying the postero-internal angle of the tooth. Low crests connect the protocone with the two outer cusps.

SPECIFIC CHARACTERS.—C-M²=8.3 mm.; M¹⁻³=6. mm. (approx.).

Two specimens, Nos. 17377, lower jaw with one molar, and 17408, loose lower incisor, premolar and molar, may pertain to this genus. The incisor is a slender, gently tapering lanceolate tooth; the premolar, presumably P₃, is two-rooted, with subconical protoconid and well-developed heel. The molars have a trigonid of two opposite, nearly equal cusps, connected nearly to their tips, and no paraconid; the talonid is broad, basined, and without hypoconulid. A transverse crest connects the hypoconid with the metaconid.

PRIMATES

Tarsiidae

Navajovius kohlhaase,² new genus and species

TYPE.—No. 17390, upper and lower jaws, probably of the same individual, from the Mason pocket in the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\frac{1.1.1.3}{2.1.2.3}$. Two lower incisors somewhat enlarged, with elongate roots and long, pointed, subspatulate crowns. Canine smaller, one-rooted, premolariform. Third premolar smaller than canine, two-rooted, crown comparatively simple; P₄ nearly as large as M₁, with trenchant heel and rudimentary metaconid. Lower molars tritubercular, with distinct but small paraconid extended outwardly as a low ledge; protoconid and metaconid equal, submarginal, talonid basined, wide and deep. Upper fourth premolar not as large as M¹, with large sub-

¹From the town of Ignacio, Colo., about seven miles west of the Mason pocket.

²From the Navajo mountains north of the San Juan River. As a mnemonic convenience the names of our new Tarsioid genera have all been derived from various mountain ranges in the region where they were found, the names chosen being of Indian derivation, and most of them originally applied to Indian tribes of the region; and they are latinized in the same form as *Tarsius*.

The species name is in honor of Miss Erna Kohlhaase, to whose skillful and patient work is due the preparation of the minute and delicate specimens from the Tiffany beds herein described.

trigonal external cusp and rudimentary internal cusp. Molars tritubercular with rudimentary hypocones on M^1 and M^2 , conules minute, no external stylar cusps.

SPECIFIC CHARACTERS.— $C-M_3=7.5$ mm.; $M_{1-3}=4.7$ mm.

Represented in the collection by the type only.

This is the only true primate thus far described from the Paleocene. The Plesiadapidae are primitive types lying on the border between Primates and menotyphlan insectivores.

INCERTÆ SEDIS

Carpodaptes¹ aulacodon, new genus and species

TYPE:—No. 17367, lower jaw with P_2-M_3 , alveolus of P_1 and part of canine alveolus. From the Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\overline{1.1.4.3}$. Canine moderately large; anterior premolars much reduced, single-rooted, knob-like, fourth premolar enlarged, secant with scalloped edge and obscure grooving toward apex of the crown. No diastemata. Molars fundamentally of tarsioid type but considerably specialized in various respects; M_2 the smallest of the series; trigonid of M_1 converted into an antero-posterior crest; protoconids of M_2 and especially of M_3 lower and smaller than metaconids; molar heels large and deeply basined. Jaw short, rather deep anteriorly, mental foramen below P_2-3 .

SPECIFIC CHARACTERS:— $P_2-M_3=8.5$ mm.; $M_{1-3}=5$ mm.

Represented in the collection by the type only.

This form cannot be definitely assigned to any family or order; it may be a primate, a menotyphlan insectivore, or neither.

CREODONTA

Triisodontidae

Eoconodon, new genus

TYPE:—*Sarcothraustes coryphæus* Cope, 1888, = *Triisodon heilprinianus* Cope, 1882. From the Paleocene (Puerco formation) of the San Juan basin, New Mexico.

A more careful restudy of the type of the genus *Triisodon*, *T. quivirensis* Cope, in connection with additional and better preserved material of the Triisodontidae, shows that it is not congeneric with *T. heilprinianus* and other species of the Puerco fauna, but that it is congeneric with *Sarcothraustes* (type *S. antiquus*) of the Torrejon fauna, which it antedates as a generic name. Moreover, the records of its locality and associated material, with the field data obtained by Mr. Granger in 1913 as to the exposure of the Puerco and Torrejon formation, confirm the suspicion that it is a Torrejon and not a Puerco species. The

¹καρρός = fruit; δάπτειν = eater, bloodsucker; in reference to the supposed habits indicated by the character of the teeth, especially the enlarged cutting premolar. The species name refers to the vertical grooving of the tooth, which shows some analogy to the Plagiaulacidae and the modern rat kangaroos.

Puerco genus represented by *T. heilprinianus* (syn. *T. biculminatus*, '*Sarcothraustes*' *coryphæus*, etc.), requires a new generic name. The type of *T. heilprinianus* is very incomplete and its exact provenience unrecorded, so that it appears better to base the genus upon *S. coryphæus* founded upon an excellent type known to have come from the true Puerco, but considered at present as a synonym of *T. heilprinianus*.

This genus is nearly related and appears to be directly ancestral to *Triisodon* of the Torrejon, the type of which genus is *T. quivirensis* Cope, 1881. The distinguishing characters separating *Eoconodon* from *Microclænodon* and *Triisodon*, the other two genera of the Triisodonti-dæ, are as follows: trigonids low, metaconids and protoconids slightly connate, subequal, paraconid strong, heel large, basined.

Oxyclænidæ

*Mixoclænus*¹ *encinensis*, new genus and species

TYPE.—No. 16601, upper and lower jaws with P^3-M^3 , P_2-M_1 left, and roots of M^{2-3} right, preserved. From the lower level of the Torrejon formation, east fork of Torrejon arroyo, San Juan basin, New Mexico. Exped. 1913.

GENERIC CHARACTERS.—The upper molars resemble those of *Chriacus*, but are wider transversely, and more triangular, external angles more prominent, hypocone less so, M^3 much reduced, transverse. Premolars with blunt-pointed, somewhat inflated crowns, more as in *Mioclænidæ*, and the more primitive *Anisonchina*. Lower canine small, partly premolariform. Jaw elongate, shallow, condyle not transverse.

SPECIFIC CHARACTERS.— $C-M_3 = 26$ mm.; $M_{1-3} = 10$ mm.

In addition to the type there is a paratype, No. 17074, a lower jaw with nearly complete dentition, and two other lower jaw fragments. All four specimens are from the lower level of the Torrejon formation.

The lower dentition of this genus is very much like that of *Coriphagus* Douglass of the Fort Union. Until the upper dentition of *Coriphagus* is discovered it appears better to hold *Mixoclænus* provisionally distinct.

¹μῑς = mingled; (*Mio*) clænus, (*Oxy*) Clænus, etc.; in reference to the synthetic character of the dentition.

STEHLINIUS, A NEW EOCENE INSECTIVORE

BY W. D. MATTHEW

In 1895 Mr. O. A. Peterson, of The American Museum of Natural History, obtained from the Uinta basin of Utah a block of shale showing numerous fragments of small vertebrates, among which the most interesting was an incomplete and badly crushed skull and jaws of a small mammal which Dr. Wortman immediately recognized as a "new insectivore," but which has never been described. I prepared this specimen under the binoculars several years ago but withheld description, hoping to have opportunity to dissect out and reconstruct the displaced fragments of the skull. I have concluded, however, that it involved too much risk to be advisable. Miss Erna Kohlhaase worked over the large block from which it had been removed, hoping to find skeleton parts or other fragments, but, although she found a number of small rodent jaws and skeleton bones of small mammals and reptiles, there was nothing that could be confidently referred to the little insectivore. Its singular and highly specialized dentition made its affinities wholly obscure, and it was only in recent years that the researches of Stehlin upon the Plesiadapidae and the discovery of several genera of this family in the Eocene and Paleocene of this country cast some light upon its probable affinities. It now appears to be an extremely specialized plesiadapid, possibly related to *Necrosorex* Filhol. The reduction of the cheek teeth is carried further even than in *Apatemys* but, unlike that genus, a large and very remarkable cutting premolar is retained in the lower jaw. This tooth, long and knife-like, has no anterior root, the base of the crown resting upon the large front tooth; the posterior root is normal. This singular construction is explicable as due to the re-enlargement of a tooth like that of *Apatemys*, which is small, knife-like and single-rooted; or else to the progressive degeneration of the anterior root due to its being crowded out through the progressive enlargement of the front tooth.¹

¹Neither explanation appears entirely satisfactory; the former is in accord with what is actually known of the phyletic record both in this family and in the parallel case of the Plagiaulacidae, but will be sternly rejected by certain advocates of "irreversibility in evolution" who attach a very different meaning to Dollo's Law from that explained by its distinguished proponent. The mechanics of the second interpretation appear to be unsound; a slight deepening of the jaw or backward migration of the anterior root would obviate any interference from the root of the front tooth, and the anterior root of a large knife-like tooth of this description would function so importantly in keeping it firm and true that it would be wholly unlikely to degenerate and disappear if there were any way of avoiding such a loss. Once lost, of course, and the tooth dependent for its support solely upon the posterior root and such bracing as it might obtain from its proximity to the socket and root of the large tooth in front, one can understand that a re-enlargement might fail to develop a new anterior root through fission of the posterior root, but instead permit it simply to rest against this anterior brace. In any event, the mechanics of this construction is very remarkable.

***Stehlinius uintensis*, new genus and species**

TYPE.—No. 1903. A right lower jaw, with part of the skull from the Upper Eocene (Uinta) of White River, Utah. Exped. 1895.

GENERIC CHARACTERS.—Dentition $\frac{1.0.2.3}{1.0.1.3}$. Incisors soricoid, greatly enlarged and root and crown much elongated, trihedral in cross-section, the crown of the upper incisor unknown, the lower incisor curving upward towards tip, the wearing surface on the posterior face obliquely concave, the enamel confined to the anterior face of the tooth. Third upper premolar indicated by a single rather large, oval alveolus, the form of the crown unknown. Fourth upper premolar small, trenchant, pointed.

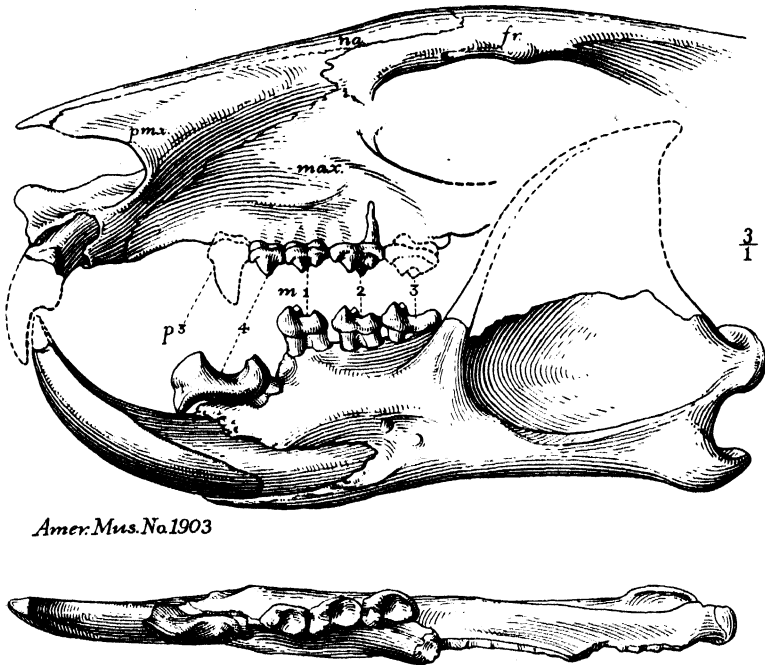


Fig. 1. *Stehlinius uintensis*, skull and lower jaw, side view, type specimen, Upper Eocene, Utah.

Skull reconstructed from the crushed original, lower jaw reversed. Three times natural size.

Upper molars brachyodont, trihedral, scalene to a marked degree, paracone and metacone prominent, rounded, subequal, parastyle and metastyle well developed, but no mesostyle; protocone prominent, rounded, posterior wing absent, anterior wing extended into a crest meeting the paracone. Lower premolar enlarged, the crown compressed and elongated, with the anterior part raised into a knife-edge and the posterior part with a strong heel-cusp. The posterior root is normal, the anterior root absent, the anterior part of the crown resting upon the incisor. Lower molars with oblique crested trigonids and large basin talonids, the paraconids being low and not

prominent. Lower jaw of moderate depth, with broad coronoid process, condyle but slightly expanded transversely, angle broad, not inflected, ending posteriorly in a stout hook-like process.

Reconstruction of the Skull

The anterior part of the skull is preserved, but so broken and distorted that its reconstruction as shown in the accompanying figure is partly conjectural, and therefore not included in the generic diagnosis.

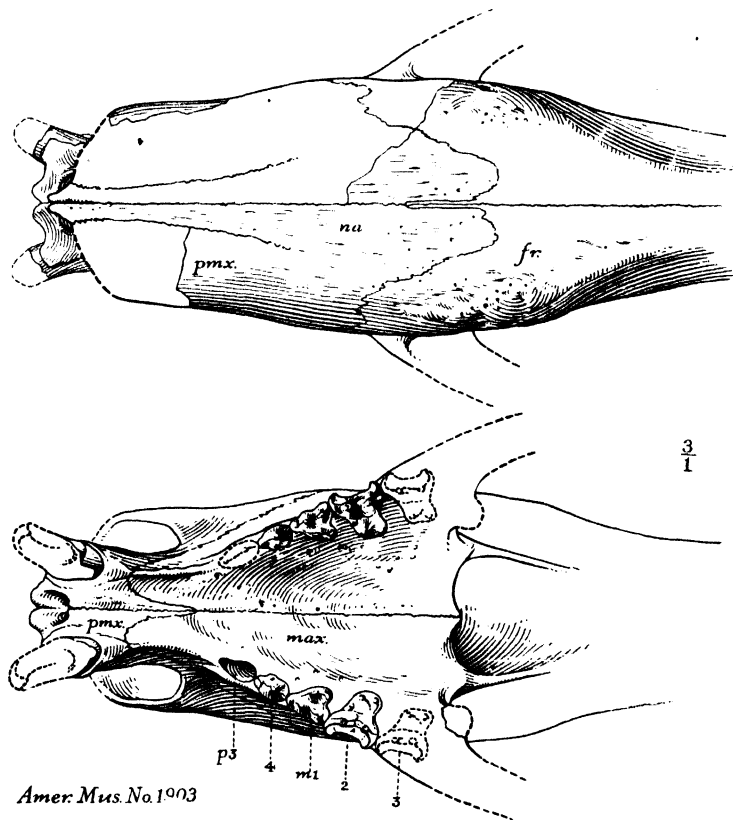


Fig. 2. *Stehlinius uirtensis*, type specimen.

A, reconstructed skull, top view; B, palate partly reconstructed. Three times natural size.

The reconstruction was drawn by Mr. Erwin Christman and is the final resultant of a series of critical studies and attempts at reconstructing the type skull by Mr. Christman, Dr. Gregory and the author; but it remains a tentative and not a positive resultant. The width and character

of the nasals and premaxillæ is based upon somewhat doubtful identification of the displaced fragments. The sutures, which are mostly well shown and afford the best evidence for the identity of these fragments, are indicated wherever we regard them as positively identifiable.

The most remarkable features of the skull are the great expansion of the ascending ala of the premaxilla, and the long and wide posterior overlap of the nasal on the frontal bone. This is clearly seen to be a superficial overlap, the frontal extending beneath the nasal plate as far forward as the preorbital line, and showing at the surface in a narrow thread along the median suture. In the marsupials the nasals are greatly extended and expanded posteriorly, but there is little or no overlap on the frontals except laterally in some forms (*Didelphys*, etc.).

The postorbital process of the frontals is indicated only by a slight rugosity, as in most Insectivora. The postorbital crests behind it are obscure, and the constriction not marked. The skull is broken off at about the line between parietals and frontals, but this suture is not certainly recognizable.

Owing to the broad ascending premaxillary plates, the width of the muzzle is considerable, but the body of the premaxilla is narrow, the incisors set close together, and above and partly in front of the incisor is a process and crest which may have been extended upward in a bony septum between the anterior nares, but is broken off in the specimen.

The palate is narrow at the incisors, but widens rapidly backward, with the maxillo-premaxillary suture crossing it in the middle of a moderately long diastema between the incisor and p^2 . There is some doubtful indication of another small tooth in this diastema. The posterior border of the palate is somewhat doubtfully recognized just back of m^2 .

Affinities

The characters of the teeth place this genus as a specialized member of the Plesiadapidæ. It may be nearly related to *Necrosorex* Filhol, of the French Phosphorites, although clearly not identical (*Necrosorex* has one too many alveoli, even if one ignores the differences in its m_3 as due to careless drawing); and, if so, it confirms Dr. Stehlin's transfer of the Phosphorite genus from the Soricidæ, where Filhol very naturally placed it, to the neighborhood of the Plesiadapidæ; thus affording another instance of the insight of this distinguished palæontologist in recognizing the true affinities of so fragmentary and deceptive a type. It has seemed appropriate on this account that the Uinta genus should be named in Dr. Stehlin's honor.

The skull characters are not very close to those of *Nothodectes*, the only genus of this family in which anything of the skull has been described. Although the skull is badly crushed in *Nothodectes* and difficult to interpret, I cannot find in it any evidence for the backward extension and expansion of the nasals or the relatively enormous ascending plate of the premaxilla that characterize *Stehlinius* if we have correctly reconstructed this part of the skull. These are marsupial, and especially diprotodont marsupial, characters; but, as noted above, the nasal expansion in this genus is a superficial overlap, quite unlike the marsupial conditions, and probably a secondary specialization from the normal primitive insectivore type; the expanded premaxillary plate is presumably also secondary and indicates parallel adaptation, not relationship to the diprotodont marsupials. Marsupial relationship is, in fact, wholly excluded by the dentition, characters of the jaw, etc.

The new genus is referred to the Plesiadapidae chiefly upon the evidence of the teeth, and without prejudice to possible claims to relationship with *Mixodectes* or *Microsyops*, which at present are assigned to distinct families.

The ordinal position of this whole assemblage of genera is very doubtful. Stehlin regards the Plesiadapidae as chiromyoid primates; Gregory and Matthew consider them as tupaoid insectivores (Menotyphla); but in any event they stand near the boundary line between the two orders. The present genus has no especial suggestion of primate about it; but that is of little significance.

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A NEW NAME FOR A SUBSPECIES OF *UTA STANSBURIANA* BAIRD AND GIRARD

BY KARL PATTERSON SCHMIDT

In the 'Check List of North American Amphibians and Reptiles' (1917), Stejneger and Barbour have followed Richardson (1915, Proc. U. S. Nat. Mus., XLVIII, p. 412, ff.) in his revision of *Uta stansburiana*.

Richardson divides the species into a northern subspecies, *Uta stansburiana stansburiana* (Baird and Girard), chiefly in the Great Basin; a southern subspecies, *U. s. elegans* (Yarrow), ranging from western Texas to Lower California; and a Pacific coast form, *U. s. hesperis* Richardson, of the coastal region of southern California and northern Lower California (and the San Joaquin Valley).

To the second subspecies Richardson applied the name *elegans* of Yarrow (1882, Proc. U. S. Nat. Mus., V, p. 442), with the type locality La Paz, Lower California. Richardson, however, had only four specimens of *Uta elegans* from the Cape Region of Lower California.

The Lower Californian collections of the Albatross Expedition made in 1911, contain an excellent series of *Uta elegans* from Lower California, numbering twenty-four specimens (seven from the vicinity of La Paz); in addition, through the courtesy of the U. S. National Museum, I have had an additional six specimens from the Island of Espiritu Santo, opposite La Paz, for examination.

The *Uta stansburianas* from Texas, New Mexico, and Arizona in The American Museum of Natural History agree excellently with Richardson's definition of *U. s. elegans*. The Lower Californian specimens, however, are at once distinguished in the greater length of the hind leg, which ranges from .74 to .85 of the length from snout to anus in eighteen male specimens, averaging .80, while in twenty-four male Arizonan and New Mexican specimens examined by me, the range is .65 to .79, average .71, and the average of Richardson's series of twenty-three males is .74.

I, therefore, regard the form in the Cape Region of Lower California as specifically distinct, and restrict the name *elegans* of Yarrow

to it. For the form in Arizona, New Mexico, western Texas, and northern Mexico, I propose a new name.

***Uta stansburiana stejnegeri*,¹ new name**

TYPE.—A. M. N. H. No. 348; ♂; collected July 23, 1906 by A. G. Ruthven.

TYPE LOCALITY.—Mouth of Dry Cañon, Alamogordo, Otero County, New Mexico.

It is hoped that a more extended study of the genus *Uta* may be presented in the future.

¹Named for Dr. Leonhard Stejneger, whose contributions to the study of the genus *Uta* make it especially appropriate that a species of this genus should bear his name.

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A REVISION OF *ATLAPETES GUTTURALIS* WITH DESCRIPTIONS OF THREE NEW RACES

BY JONATHAN DWIGHT AND LUDLOW GRISCOM

The recent receipt of excellent material from Guatemala, Nicaragua, and Costa Rica of this wide-ranging highland species led to the discovery that the series from the localities mentioned above differed markedly from each other. Accordingly other available material was brought together, resulting in a series of nearly 100 specimens, representing thoroughly age, season, and locality. A careful study of this series shows that Dr. Chapman's *brunnescens* is restricted to the highlands of Chiriqui, and that the birds inhabiting the geographically isolated highlands farther north constitute three well-defined races to be described below.

Several other points have come up in the course of our study which we here record. The first is that skins in the course of time (in less than thirty years, certainly) unquestionably turn brown, and are therefore useless for subspecific comparison, a fact which Dr. Chapman has already recorded for many species from old Bogotá collections. We have seen such discolored skins from "Bogotá," Costa Rica, and Guatemala, and it was the receipt of fresh material from Costa Rica which first called our attention to this fact. When Dr. Chapman described *brunnescens* and referred all Central American material to this race, he had only a few birds from Nicaragua, three old skins from Costa Rica, and an old Lawrence skin from Guatemala in addition to an excellent series from Chiriqui. These old skins have turned brown and are not separable from Chiriqui specimens, but fresh material proves to be quite different. Mr. Ridgway, the only other ornithologist who has treated the species at all recently, lists only six specimens.

While we describe the Nicaraguan bird below, additional material having been acquired, it is only proper to state that it could never have been described with the material which Dr. Chapman had available. It differs but slightly from *brunnescens*; in fact, we would hesitate to describe it were it not for the fact that a different race in Costa Rica separates it from its closest relative. This leads to a second fact about *Atlapetes gutturalis*, namely, that its racial variation is not geographically progressive from one end of its range to the other. Thus, the Costa Rican

race is very close to typical *gutturalis* from Colombia, and would scarcely be worthy of a name were it not for the very distinct *brunnescens* intervening. Similarly, as stated above, the Nicaragua form is closely related to *brunnescens*, while the Guatemala race, far from continuing what might be called the subspecific tendency of the Nicaraguan bird, is distinct from either of the other two groups. This type of variation is already known for several other highland species in Central America, and results unavoidably in a considerable number of subspecies, some of which are very close indeed.

The variations due to age and season are well shown by the series at hand, which also illustrates the moults, so that comparisons of like plumages may be made and subspecific differences better determined. Every month in the year is represented and in the series are a number of moulting birds which follow the usual course of the moult in sparrows and finches. The postnuptial or annual moult takes place in the fall during August, September, October, and November, the Colombian birds being about a month later than the others. Two Chiriqui birds of August 21 and September 21 each still retain the old first (ninth) primary while the other wing-quills, the tails, and a large part of the body plumage are new. In two Colombia birds of October 26 and November 13 all the primaries are new, the first (ninth) about one half grown. Although this moult is in the fall in all of the races, the young seem to leave the nests at different periods. Birds in full juvenal plumage of the Costa Rica and Chiriqui races are dated May, June, and July, acquiring their first winter dress through a partial moult by the end of August, while similar birds of the Colombia race dated March have acquired their winter dress by the end of March. It is probable that the time of the rainy season in the different regions governs the time of moult and occasions the variations.

These birds do not suffer much from wear. The tendency is for the feathers of the back to become paler. When fresh, they often have dusky margins, and loss of these as well as fading tend to make the grayer feathers paler and the browner feathers lighter, although each preserves its original tone to a large degree.

There is also a partial prenuptial moult in the spring involving only some of the head, throat, and anterior parts of the body. This freshens up the plumage and is most noticeable perhaps on the back. An understanding of the plumage changes is needful in order to comprehend the variations that are entirely geographical.

We give below diagnoses of the five subspecies of *Atlapetes gutturalis*. All measurements are in millimeters. The special color names employed

are taken from Ridgway's 'Color Standards and Color Nomenclature' (1912). We are indebted to Mr. Waldron deWitt Miller for his courtesy in letting us study and describe the Nicaraguan material.

***Atlapetes gutturalis gutturalis* (Lafresnaye)**

SUBSPECIFIC CHARACTERS.—Back deep mouse-gray; white headstripe broad, throat patch lemon-yellow; breast whitish; flanks and under tail-coverts deep olive-gray; averaging very slightly larger than any other race, bill decidedly larger.

MEASUREMENTS.—Males: wing, 73–80 (77.4); exposed culmen, 15–17 (15.5). Females: wing, 71–79 (74.1); exposed culmen, 14–16 (15.1).

RANGE.—Highlands of Colombia, 3000–8500 feet.

SPECIMENS EXAMINED.—♂ 10; ♀ 14; not sexed 5; juv. 5.

***Atlapetes gutturalis brunnescens* Chapman**

SUBSPECIFIC CHARACTERS.—Decidedly browner than typical *gutturalis*. Back between olive-brown and fuscous; headstripe narrower; throat patch slightly deeper yellow; breast whitish; flanks and under tail-coverts buffy brown; size similar to *parvirostris*, smaller than *gutturalis*, particularly the bill.

RANGE.—Highlands of Chiriqui.

SPECIMENS EXAMINED.—♂ 14; ♀ 1; not sexed 3; juv. 10.

***Atlapetes gutturalis parvirostris*, new subspecies**

SUBSPECIFIC CHARACTERS.—Very similar to typical *gutturalis*. Back very slightly darker grey; headstripe equally wide; throat patch slightly lighter yellow; breast whitish; flanks light grayish-olive; averaging slightly smaller with a noticeably smaller bill, in this respect resembling *brunnescens*.

TYPE.—No. 52724, Coll. J. Dwight; ♂ ad.; Aquinares, Costa Rica, altitude 4500 feet, March 27, 1920.

MEASUREMENTS.—Males: wing, 70–78 (73.6); exposed culmen, 13–15 (14). Females: wing, 72–76 (74.0); exposed culmen, 14.

RANGE: Highlands of Costa Rica.

SPECIMENS EXAMINED.—♂ 7; ♀ 2; juv. 5.

***Atlapetes gutturalis fuscipygius*, new subspecies**

SUBSPECIFIC CHARACTERS.—The brownest of all the races. Most closely resembling *brunnescens*, but upper parts even browner, especially on the lower back and rump, approaching raw umber; headstripe narrow as in *brunnescens*; throat patch and breast similar; flanks and under tail-coverts saccardo-umber, much browner than in *brunnescens*; size of the other Central American races.

TYPE.—No. 101517 A. M. N. H.; ♂ ad.; San Rafael del Norte, Nicaragua, altitude 4000 feet, April 14, 1907.

RANGE.—Highlands of north central Nicaragua.

SPECIMENS EXAMINED.—♂ 3; ♀ 3.

***Atlapetes gutturalis griseipectus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Not closely resembling any of the other races. Back lighter in tone than *parvirostris* and more olive, olive-gray rather than mouse-

gray; headstripe broad, as in typical *gutturalis* and *parvirostris*; throat patch lighter yellow and more extensive than in any other race; breast distinctly clear gray, not whitish as in other races; flanks and under tail-coverts saccardo-olive, more olive, and less brown or gray than other races; size of the other Central American races.

TYPE.—No. 52725, Coll. J. Dwight; ♂ ad.; Quezaltenango, Guatemala, altitude 8500 feet, November 18, 1919.

RANGE.—Highlands of central Guatemala.

SPECIMENS EXAMINED:—♂ 5; ♀ 2; not sexed 1.

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NOTES ON A NEW OX-PECKER AND OTHER LITTLE-KNOWN BIRDS OF THE CONGO¹

BY JAMES P. CHAPIN

In the working up of our collection of Congo birds there appear continually points of interest regarding the distribution and relationships of the rarer birds of this region, which seem to merit immediate publication and a little more space than can be allotted to them in the final report. For this reason, we offer the following remarks on species recently subjected to special investigation.

A NEW *BUPHAGUS* FROM THE LOWER CONGO

The Tick-birds or Ox-peckers of Africa have been universally conceded to belong to two species, both of them widely distributed over the eastern and southern parts of Africa and both extending to Senegal in the northwest. Yet, they invariably shun the forested regions, especially of the Congo basin; and, while Professor Reichenow² states that *Buphagus africanus* is found locally in the western forest area, he gives in his great work only one such record from Lower Guinea: Gaboon (Marche and Compiègne). In his list of birds known from the Cameroon³ we find no mention of either species.

This is entirely in accord with our experience during the American Museum Congo Expedition. Nowhere in the forested districts did we ever see or hear of an Ox-pecker, not even where cattle or horses were being kept, as at Stanleyville. But there are parts of the Gaboon which are certainly not to be reckoned as forest, since numbers of savanna birds extend their range northward from the Lower Congo along the west coast, and one of these must be a *Buphagus*.

At Faradje, Upper Uele District, where in 1911 some 700 head of cattle were living on the Government farm and the European traders and administrative agents possessed a few horses and mules, no Ox-peckers ever came to visit the domestic animals, although this was well to the north of the forest border. With the big game of the region, however, and even farther south near the Kibali River, there were frequently

¹Scientific Results of the American Museum Congo Expedition. Ornithology No. 6.

²1903, 'Vögel Afrikas,' II, p. 666.

³1911, Mitteilungen aus dem Zool. Mus. Berlin, V, p. 251.

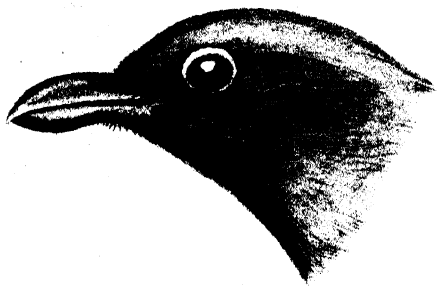
Tick-birds of the so-called yellow-billed species, whose bill nevertheless has the terminal half bright red. They were found in rather small numbers in attendance upon the white rhinoceros, buffalo, giant eland, and occasionally even the wart-hog. Their well-known habits need no mention here; but the facts that they never approached human habitations and were never observed about the cattle are rather surprising.

Along the eastern border of the Belgian Congo, and especially in the Katanga, Ox-peckers of both the yellow- and red-billed species must doubtless occur; yet the only other place where any *Buphagus* was observed by us was at Zambi, on the Lower Congo. There Mr. Van Saceghem, a Belgian veterinary, kindly procured two specimens for me in January 1915; and Mr. Lang collected three more in June and July of the same year. They were seen commonly about the domestic cattle, and yet only a few miles away at Boma I sought in vain for them with the herds. I was even told that they did not show themselves on the Island of Mateba, where cattle raising is the principal industry. According to Mr. Drousie, Directeur de l'Agriculture at Boma, they were not seen at Zambi previous to 1908, appearing first in company with a herd installed at some little distance north of the river; and then, when these were brought back to the station, the birds came too.

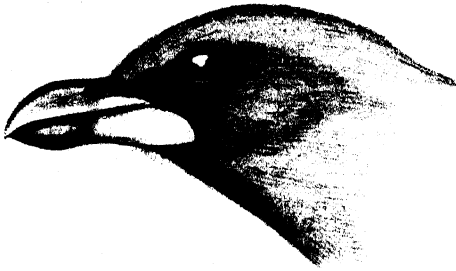
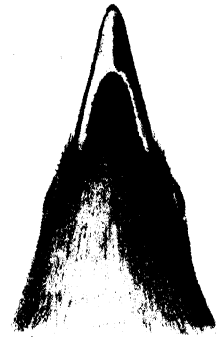
Both Mr. Lang and I noticed at once that these Ox-peckers were of a much darker color, especially on the rump, than those of the Uele; and later I found that they agreed more or less in coloration with *Buphagus erythrorhynchus*, even to the dark shade of the rectrices. Yet the bill, instead of being entirely red, had been bicolored exactly as in *B. africanus*. Comparison with specimens made it clear at once that *erythrorhynchus* had a bill of quite another shape, yet this difference between the two well-known species, while alluded to in Stark and Selater's 'Birds of South Africa,' is generally disregarded in favor of color distinctions that are not at all evident in the beaks of old dried skins.

The bill of *Buphagus africanus* is much heavier than that of *B. erythrorhynchus*, especially on account of the pronounced widening of the basal half of the mandible, the sheath of which, in many adult specimens, is even produced inwardly below so as to encroach upon the feathering of the chin. This character was enough to place our darker birds from Zambi unquestionably in the *africanus* group, and, furthermore, they lacked all trace of the widened yellow eyelid of *erythrorhynchus*.

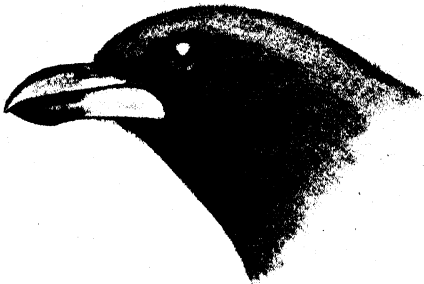
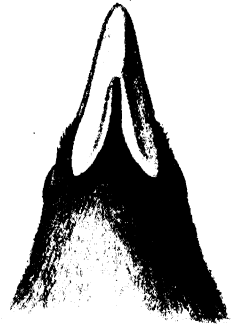
Were the species of this curious group of birds more numerous, it would doubtless be fitting to divide them in two genera, and such well-



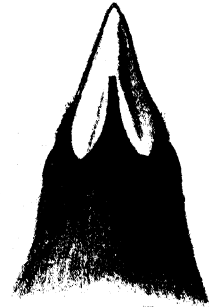
a



b



c



JPC

Fig. 1. Beaks of the three species of Ox-peckers, as seen from the side and beneath.
A, Buphagus erythrorynchus; b, B. africanus; c, B. langi. Natural size.

marked characters would be amply sufficient for the purpose. As matters stand, I propose the subgeneric term **Buphagoides** to distinguish the species *erythrorhynchus*.

An examination of the specimens of *Buphagus africanus* in the American Museum, the Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoology (eleven specimens from widely different parts of the continent) fully confirms the color differences between the common Yellow-billed Ox-pecker and that of the Lower Congo. Not only does the latter represent a hitherto undescribed form, but, since there is no evidence whatsoever of intergradation between them, I consider it as specifically distinct from *Buphagus africanus* and restricted in all probability to the Lower Congo and the adjoining part of the Gaboon. It may well be that the record of Marche and Compiègne refers to this dark form. I propose to name it in honor of Mr. Herbert Lang, leader of the American Museum Congo Expedition, with whom I have worked during five pleasant years in Africa.

Buphagus langi, new species

SPECIFIC CHARACTERS.—Related to *B. africanus*, but smaller and more darkly colored, especially on the breast and on the rump, the latter being grayish instead of rich yellowish buff. No rufous on the rectrices.

TYPE.—♀ ad.; A. M. N. H. No. 163005; Zambézi, Lower Congo, January 16, 1915.

DESCRIPTION OF ADULT FEMALE (Type).—Whole head and throat dull dark brown ("fuscous" of Ridgway); back, wing-coverts and secondaries similar; the primaries and their greater coverts fuscous black; under wing-coverts fuscous. Lower rump and upper tail-coverts "grayish olive"; rectrices darker, like the back, both on inner and outer webs. Below, the dark brown of the foreneck shades gradually to a dull cinnamon-buff on the lower breast, abdomen, and under tail-coverts, while the flanks are of a warmer ochraceous buff, tinged with cinnamon. Iris yellow; base of bill bright yellow, its distal half scarlet; feet blackish.

MEASUREMENTS OF TYPE.—Wing, 107; tail, 74; culmen, 15; tarsus, 21.

Of the four remaining specimens, one is an immature male, one an immature female, and the two others have bills like adults, but were not sexed. One of these from its rather large size is presumed to be an adult male, yet it is slightly darker than the type.

The immature male has the whole bill still dark brown, and exhibits an ashy wash over the head, back, and chest, which I believe to be characteristic of the first plumage.

Measurements of Five Specimens of *Buphagus langi* (both sexes).—Wing, 106.5–113 (average, 109.1); tail, 74–81 (77.9); culmen, 13.5–15 (14.2); tarsus, 20.5–21.5 (21). The dimensions of *B. africanus*

are given by Reichenow ('Vögel Afrikas,' II, p. 666) as: wing, 120; tail, 90-105; bill, 16-18; tarsus, 21-23. The wing does vary, I find, from 117 to 124 mm., but *Buphagus africanus* does seem to be a decidedly larger bird.

THE NECTARINIA OF THE BANGALA COUNTRY

This long-tailed genus of Sunbirds is especially characteristic of the plains regions of Africa and, until a few years ago, seemed to be without a single representative in forested western Africa. Then, in April 1910, van Oort¹ described both male and female of a new species, *Nectarinia congensis*, which had been sent in alcohol from Boma on the Lower Congo by A. Greshoff to the Zoological Laboratory in Utrecht, and there had remained unnoticed for twenty-one years.

No further reference to the species has appeared since its original description, as a result, I believe, of the true range of this fine Sunbird along a river where few ornithologists have tarried to make collections. Some nine months before van Oort's description appeared, we were making the ascent by steamer of the Upper Congo River, profiting by every stop to jump ashore and secure specimens, mostly of birds. The Sunbirds in particular attracted our attention, but no long-tailed species was noticed at Boma, Matadi, or Leopoldville, nor indeed until we had reached Bumba, on July 29. At Barumbu, two days later, we collected an adult male specimen, and thereafter saw no more of the species, even during our stay at Stanleyville.

It may seem strange that a Sunbird characteristic of the forested course of the Congo River should not occur on the Upper Aruwimi or the Ituri, yet such appears to be the case. Stranger still is the fact that *Nectarinia congensis* was not found by us at even Stanleyville during October and November, 1914.

I determined therefore to keep a special watch for it on the way down the Congo and, at the end of the very first day's journey, at Isangi, the acquaintance was renewed. About the government station there some of the roads are lined with the beautiful tree *Poinciana regia*, known as the "Flamboyant" and introduced, I am told, from Madagascar. To its gaudy red flowers, now open in great numbers, there came a few of the Sunbirds I sought, and a male and female were secured.

The next day we stopped for an hour at Barumbu, and here on the same kind of flowering tree I again watched a few of these Sunbirds. On other native trees they were observed later near Lié, near Coquil-

¹1910, Orn. Monatsb., p. 54.

hatville, and at Irebu (December 17), usually near or over the river-bank. All our specimens, with the exception of one not quite fully adult, were found to be in breeding condition; this was even the case with the male taken in July.

Near Lié a typical Sunbird nest was hanging from a bush, some six feet above the water, and a male of *Nectarinia congensis* sitting by it seemed to prove the ownership, though, because of the flooded condition of the stream, it could not be reached during our very short stop.

Below Irebu this species of Sunbird disappeared and, though I collected subsequently for several weeks in the neighborhood of Boma, it was never seen there either. I cannot help feeling that Greshoff's specimens really came from much farther up the river. Two days below Irebu by steamer the Congo emerges from the equatorial forest into the southern savanna, with a very distinct fauna; and what forest one sees along the Congo near its mouth is mainly a very heavy growth of mangrove. If our Sunbird inhabited this, we may take it for granted that it would long ago have been collected on the Gaboon coast. So far as my observations go, *Nectarinia congensis* inhabits the banks of the Upper Congo, from Irebu, near the entrance to Lake Tumba, up to Isangi, at the mouth of the Lomami River. The distance is about 500 miles, but I suspect that the birds keep very much to the banks of the larger streams in this region and never go beyond the limits of the equatorial forest belt.

Van Oort's description is very good, especially in view of the long sojourn of his specimens in alcohol. All we need add to it is that the burnished green chest of the male has a bluer posterior edge, sometimes even violet, and that the longer upper tail-coverts are of a like shade. In the case of the female, the upper side of the tail shows a faint green gloss, and the foreneck is heavily spotted with dull blackish.

With regard to measurements, those of the eight males in our collection are: wing, 63-66 (average, 64.5); middle rectrices, 110-125.5 (117.3), second longest pair, 49-52.5 (50.7); exposed culmen, 19-20 (19.3); metatarsus, 16-16.5 (16.1). The two females have smaller dimensions: wing, 56, 59; middle rectrices, 44.5, 45; second pair, 41, 41.5; exposed culmen, 16, 18.5; metatarsus, 15.5.

NEOLESTES CABANIS AND ITS ALLIES

At the confluence of the Kasai and Congo Rivers, on December 19, 1914, I made the acquaintance of a bird subsequently identified as *Neolestes torquatus* Cabanis, collecting three specimens. Having no

means of learning its name at the time, I attempted at least to determine the family which it represented and, from the general form of body, limbs, and other details, I soon decided that it belonged with certainty to the Pycnonotidæ, in spite of the rather unusual color pattern, largely green above, white and gray below, with crown and nape ashy, and a broad black line extending from the lores to behind the eye and down across the breast. The bill reminded me of that of *Pycnonotus*, but was wider and more arched; the feet did not belie such a relationship, the metatarsi being short and scutellate. The sexes were alike in color. I felt the more confident because all three of my specimens, shot among the bushes in upland savannah, had been eating small fruits; and their voice was a sort of twitter that suggested a Bulbul.

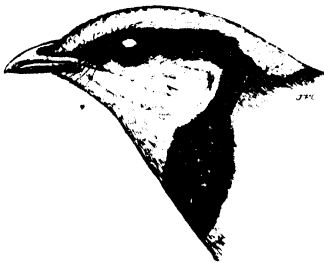


Fig. 2

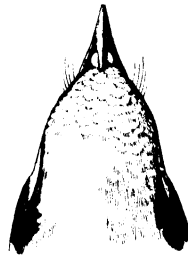


Fig. 3

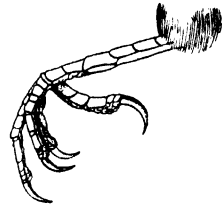


Fig. 4

Fig. 2. Head of *Neolestes torquatus*, adult male.
Natural size.

Fig. 3. Head of *Neolestes torquatus*, from above.
Natural size.

Fig. 4. Left foot of *Neolestes torquatus*.
Natural size.

Later in the same day, at Kunzulu, somewhat farther down the Congo River, a nest of this same bird was found in a bush, four feet from the ground. It was a frail cup of slender grasses and plant stems, holding two eggs, pinkish white indistinctly speckled with darker pinkish and a faint rufous zone about the larger end. Here, I thought, were additional indications of affinity to the Pycnonotidæ.

During the following month, January, near Boma on the Lower Congo, three more individuals were observed, though none was collected, because of their extreme wariness.

When I came to the identification of my specimens at the American Museum, no genus of Pycnonotidæ could be found in which they seemed to fit, and my search extended to the Laniidæ before it bore fruit. There

the monotypic genus *Neolestes* was placed by Reichenow¹ in the following association: "*Chlorophoneus*, *Pelicius*, *Neolestes*, *Calicalicus*, *Nicator*. . . ." Dr. Sharpe,² too, includes *Neolestes* in the Malaconotinæ, and Selater,³ in Shelley's 'Birds of Africa,' inserts it between *Malaconotus* and *Telophorus*, the latter a group of green-backed Shrikes referred by Reichenow to *Pelicius* and *Chlorophoneus*. This association of *Neolestes* is plainly unnatural, and an extract from Cabanis' original description⁴ will show how the error came about. "It belongs to none of the known genera, and its insertion in the classification is rather difficult. For the present it had best be considered, like *Calicalicus* for example, as an aberrant form of the Malaconotinæ, and be placed in the neighborhood of that genus."

The specimens of *Calicalicus madagascariensis* I have examined in the Philadelphia Academy collection reminded me much more of the Paridæ than of any other family; they certainly bore no special resemblance to *Neolestes*. *Calicalicus* is placed by some writers in the Vangidæ, but this question I shall not attempt to settle. Beyond a doubt, Cabanis' opinion as to *Neolestes* belonging in the Malaconotinæ was based on a superficial resemblance to certain green-and-yellow Shrikes with black breast-bands, of which I have two species (*Chlorophoneus quadricolor* and *Pelicius zeylonus*) for comparison. The likeness is extremely faint, even the black band on the side of the head occupying an entirely different position, since in *Neolestes* it passes completely above the ear-coverts and in these Shrikes below them. Following up the question of coloration, we may note that the young of *Chlorophoneus dohertyi* is barred on the body⁵—a shrike character—whereas that of *Neolestes* is not thus marked but closely resembles the adult, as does the young of *Pycnonotus*.

The bill of these Shrikes is typical of the Malaconotinæ; that of *Neolestes* approaches the form seen in *Pycnonotus* (see Figs. 2 and 3) but is relatively even broader at the base, while the nasal operculum is better developed. The lengthened nuchal filoplumes, sometimes said to characterize the Pycnonotidæ, are almost completely lacking in our specimens of *Neolestes*, but this is of slight importance, for they are found in *Malaconotus* and even among some Ploccinæ as well developed as in many Bulbuls.

¹1914, 'Die Vögel,' II, p. 289.

²1903, 'Hand-List of Birds,' IV, p. 299.

³1912, 'Birds of Africa,' V, part 2, p. 405.

⁴1875, 'Journal für Ornithologie,' p. 237.

⁵1902, Rothschild, Nov. Zool., Pl. IX.

The wing helps but little in our decision. Like both *Pycnonotidæ* and *Malaconotinæ*, *Neolestes* has it ten-primaried and rounded. In *Pycnonotus* the fifth and sixth primaries (counting from inside) are longest, in *Neolestes* the sixth, in *Pelecinus* sixth and seventh. In the adult of *Neolestes* the tenth primary is relatively shorter than in *Pycnonotus tricolor*, but this in turn has it shorter than in *Pelicius*. The foot of *Neolestes* is not at all shrike-like. The metatarsus is too short, and its scutellation not at all like that of *Pelicius* and most *Laniidæ*, but much more similar to that of the *Pycnonotidæ*, though not so nearly "booted" as in *Pycnonotus*.

My first impressions in the field are thus confirmed. Although my judgment is based on external characters, for no anatomical material was preserved, *Neolestes* seems undoubtedly a *pycnonotid*. I believe, indeed, that its affinities are closer to *Pycnonotus* than to any other African genus of the family.

Now I find that all this has been anticipated by Dr. Gadow, as long ago as 1883, in Vol. VIII of the 'Catalogue of Birds in the British Museum.' Although retaining *Neolestes* in the *Laniidæ*, probably only for convenience, he clearly states in the introduction to that family that *Neolestes* and *Calicalicus* are so aberrant as to form links with the *Pycnonotinæ*. Furthermore, he appends to the Key to the Genera of *Malaconotinæ* (p. 103) a footnote which subsequent writers seem to have ignored almost completely, though it is well worth quoting here, since my present remarks are simply a confirmation of it.

Here may be mentioned *Neolestes* . . . which has been placed by Cabanis near *Calicalicus*; it does not appear to be a Bush-Shrike, but to be allied to the Bulbuls or *Pycnonotinæ*. Bill not laterally compressed, but considerably broader than high; genus decidedly curved downwards, and not upwards as in all *Laniidæ*; nostrils with a well developed coriaceous operculum; strong rectal bristles; tail rounded and slightly shorter than wings.

Such a critical examination of one genus of supposed Shrikes might well prompt one to ask "What of *Nicator*?" I well remember meeting for the first time in the field two species of this African genus, *N. chloris* and *N. vireo*, and my reluctance to place them among the *Laniidæ* has never been quite overcome. *Nicator*, of course, bears little resemblance to *Neolestes* and is undoubtedly more shrike-like, with the bill straighter, narrower, and distinctly hooked, the metatarsus long, the toes short. Yet here most of its shrike characters seem to end. I do not feel that the spotting of its wings and tail necessarily indicates a relationship with *Malaconotus*, but was at first tempted to associate it rather with *Bleda* among the *Pycnonotidæ*, which also has a straight compressed

bill with more or less of a hook. The feet of *Nicator* and *Bleda* are similar in proportions, though the metatarsus is scutellate in the first, practically booted in the second. Both genera have a peculiar gap in the feather tract of the back of the neck, and outer primaries of similar proportions.

At all events, I feel that *Nicator* is as near to the Pycnonotidæ as to any member of the Malaconotinæ, though perhaps belonging in neither of these groups. Attention may here be called to one peculiarity of

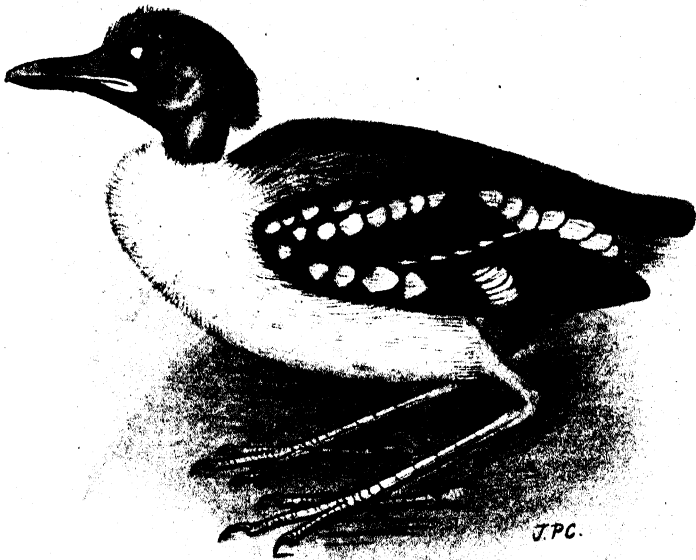


Fig. 5. Nestling of *Nicator chloris*, to show bare face and neck.
Natural size.

Nicator which is of interest. The true rictal bristles, in contrast to those of *Bleda*, are rather poorly developed and they are replaced functionally by a different group of feathers, situated much closer to the eye, the shafts of which are stiffened and prolonged, the barbs being greatly reduced. There is no approach to this in *Bleda*, and but little resemblance in *Malaconotus*.

The feathering of the nestling *Nicator* is very peculiar and quite different from that of any young Shrike (Fig. 5). At the time when the wings are half grown and the body already well feathered, the feathers of throat and cheeks, as well as those around the eyes, ears, and base of bill, have still failed to put in appearance and there is a broad median apterium running the whole length of the crown, of which no trace can be seen in the adult. The only feathers on the head are thus in two lateral lines on the crown, which join on the nape but are isolated from the spinal tract. The legs are entirely bare of feathers up to the lumbar tract and the appearance of such young birds is unique, the fluffy feathers of the upper breast forming a sort of ruff. I do not think that this is paralleled in *Bleda*, of which I have, however, seen no specimen quite young enough for comparison.

The juvenal plumage of *Nicator* is similar in color to that of the adult, whereas that of *Bleda syndactyla* and *eximia* is strikingly different, for the upperparts, excepting the remiges and rectrices, are mostly of a peculiar rufous or maroon, the underparts whiter; and this first plumage, which recalls that of *Turdinus* (Timeliidae), is molted even before the tail has attained its full length.

THE JUVENAL DRESS OF *SIGMODUS RUFIVENTRIS MENTALIS*

In glancing over our series of this bird from the Ituri and Uele, it is evident at once that immature examples are very differently colored about the head from adults, which have smooth bluish gray feathering on the crown and cheeks, set off sharply from the black collar encircling the whole neck. Instead, immature birds with black bills are found to have the lores and rictal bristles black, and a dark band extending from behind the eye to the nape, while the black collar does not encircle the foreneck.

A still younger individual, of female sex (A. M. N. H. No. 161114) with wings and tail fully grown, is seen to have a whitish collar extending almost entirely around the hind neck, and the cheeks and throat nearly white. The throat is separated from the purer white chest-patch by a narrow band of rufous crossing the foreneck. Even this specimen, however, has already begun to molt out of the juvenal plumage, for all its secondary coverts are black, and only a white spot at the tip of the second alula-quill gives a hint of their color in the first plumage.

Such a nestling as that shown in Figure 6 would be a puzzling bird to identify if we did not have some of the transitional stages. Most of the change to the adult plumage seems, nevertheless, to take place in a

single post-juvenal molt, which begins with the wing-coverts and is retarded longest about the head. Before the plumage of the head has been entirely renewed the molt of the remiges and rectrices is under way.

The young bird we figure (A. M. N. H. No. 161117, ♂) shows one peculiarity in which it is most unlike the Shrikes, though this genus and *Prionops* have very often been included in the Laniidæ. On the back of its crown there are two large bare patches of skin, separated by a narrow



Fig. 6. Nestling of *Sigmoides rufiventris mentalis*, with white wing-coverts and parietal areas of naked skin.

Colors of plumage largely blackish and white, as in the figure; but throat tinged with cinnamon, and lower breast, belly, and under tail-coverts pale cinnamon-rufous, very much lighter than in the adult. Natural size.

median line. Feathers will later grow from this skin, but they are always a little shorter there, a condition which aids in the sharp definition of the blue-gray cap in the adult.

What the difference in color-pattern between adult and young may mean we cannot be entirely certain, but it looks like a good case of recapitulation, an ancestral plumage appearing in the young only. The

adults of several species of the related genus *Prionops* have considerable white on the wing-coverts. As passerine families go, the Prionopidae seem to be well marked off from the true Shrikes; but the affinities to the two typical African genera of some of the other forms associated with them, as for instance in Sharpe's 'Hand-List,' seem to me most questionable.

THE SECOND KNOWN LOCALITY FOR *LECYTHOPLASTES PREUSSI*

The Cliff Swallow discovered by Preuss at the falls of the Sannaga, near Edea, Cameroon, and named in his honor by Reichenow,¹ has thus far never been reported elsewhere. It plastered its bottle-shaped nests, wrote Preuss, with flasklike necks pointing obliquely downward, in great colonies on the vertical cliffs, right below the waterfall; and there he caught as many as he liked with a butterfly net.

While making a journey from Faradje to Dungu, Upper Uele District, in 1911, I arrived on June 1 at the rest-house overlooking the River Dungu, about midway between the two posts and known as Gangara na Bodjo (= Bodjo's Hill). Flying about the huts and alighting on the bare ground around them was a flock of a dozen small swallows that looked new to me. I secured three, all adults, and was delighted to find that they resembled small Cliff Swallows, a group that I had not met thus far in the Congo. I recalled that in the preceding February, somewhere along this same part of the road, I had noticed some unusual swallows but thought at the time that they might be *Hirundo puella*. I am sure now that they were not.

At the time our specimens were taken they must have been breeding and were in worn plumage. The sexual organs of one male were noted as "much enlarged," those of the second as somewhat enlarged, and the ovary of the female slightly so. That they were not simply a wandering flock, far out of their normal range, is likewise indicated by my meeting a lone individual, on April 15, 1912, in the same general region, only about twenty-five miles to the south or southeast. To be more exact, it was a four hours' march west of the village of Gangura, an Azande chief, that this single bird was found, flying about near a strip of woods; but in shooting it I had the ill fortune to mutilate it beyond all usefulness. Though I twice had occasion to visit Gangara na Bodjo again, I never found the swallows there; their great rarity, or extremely local distribution, is attested by the fact that they have never been re-

¹1898, Orn. Monatsb., p. 115.

ported from any other localities than those above-mentioned, which are separated by a distance of 1300 miles. There can be no doubt of the breeding of Preuss' Swallow somewhere near the Dungu River, but just where we found it there seem to be no suitable cliffs at all. The only hill of any size I know in that vicinity is at Piagga, one day's march nearer to Faradje, where a splendid overhanging cliff was found in February 1913 to shelter a nesting colony of *Micropus affinis*. Yet no *Lecythoplastes* were observed; and on other higher hills near Aba, Garamba, Gangura's, Nzoro, and Dungu, only *Hirundo puella* and *Riparia rufiquila* were found occupying the cliffs.

In view of the great distance from the type locality, the natural impulse is to look for slight differences in characters, but I can find none whatever. Reichenow's description fits exactly, even to measurements. Those of our specimens are: wing, ♂, 97, 96, ♀ 96; tail, middle feathers, ♂, 42, 42.5, ♀, 42; outer rectrices, ♂, 53, 53.5, ♀, 53; exposed culmen, ♂, 6.6, 6.2, ♀, 6.8; metatarsus, ♂, 10.3, 11, ♀, 10. The sexes do not differ any more in color than in size; one of our birds lacks the white spots on the outer pair of rectrices, but it is a male.

EASTERN LIMITS OF DISTRIBUTION FOR SOME WEST AFRICAN BIRDS

Collections made in recent years in Central Africa have shown repeatedly how many characteristic West African species extend their range from the Cameroon all across the Congo forests and even to the Lake Region. The number of such forest birds that have been taken near Beni, on the eastern border of the Belgian Congo, is surprising; and Dr. V. G. L. van Someren has recently made notable additions to the Uganda avifauna of species previously known only from West Africa.

A certain number of specimens in our Congo collection, representing West African forms that were not previously known to range so far into the Northeastern Congo or have been perhaps only once recorded from that part of the colony, are worthy of mention here.

Canirallus oculus ([Temminck] Hartlaub)

4 ♂, 2 ♀, Gamangui (Ituri); 1 ♀, Medje (Ituri); 2 ♂, 1 ♀, Niapu (Bomokandi).

Podica senegalensis senegalensis (Vieillot)

1 ♂ im., 1 ♀, Panga (Aruwimi R.); 1 ♂ with gray throat, 3 ♀, Avakubi (Ituri); 1 juv., Niapu (Bomokandi); 1 ♀ im., Niangara (Uele). Already recorded by Dubois¹ from Panga.

Lampribis rara Rothschild, Hartert and Kleinschmidt

1 ♀, Avakubi; 1 ♂, Niapu.

¹1905, Ann. Mus. Congo, Zool., (4) I, fasc. 1, p. 24.

Lamprolaima olivacea olivacea Du Bus

1 ♂, Avakubi.

Tigronis leucolopha (Jardine)

1 ♂, 1 ♀, Gamangui; 1 ♂, Medje; 2 ♂, 1 ♂ juv., Niapu.

Urotriorchis macrourus ([Temminck] Hartlaub)

1 ♀ im., Avakubi. Dubois has already reported it from Banalia.

Astur castanilius (Bonaparte)

1 ♂, Gamangui; 2 ♀ im., Medje. The recently described *Accipiter beniensis* Lönnberg is apparently synonymous.

Accipiter sharpei Reichenow

1 ♂, Bengamisa (R. Lindi); 1 ♂, 1 ♂ im., Banalia; 1 ♀ im., Bafwasende (R. Lindi); 1 ♂, Avakubi. I consider *Accipiter zenkeri* and *A. erythropus*, which has recently been reported by Sassi from Beni, to be probably the immature stages of *A. sharpei* and *A. hartlaubi*. In such a case the name *sharpei* would be antedated by *zenkeri*.

Hieraaetus africanus (Cassin)

1 ♀, 1 ♀ juv., Niapu.

Dryotriorchis batesi Sharpe

1 ♂, Stanleyville; 6 ♂, 3 ♀, Avakubi; 1 ♀, Medje; 1 ♀, Niapu; 1 ♀, Akenge (Bomokandi).

Baza cuculoides (Swainson)

1 ♂, 2 ♀, 2 ♀ im., Avakubi; 1 ♀ im., Ngayu (Ituri); 1 ♂, Rungu (Bomokandi). There is one previous record from Semio (N. Uele).

Scotopelia bouvieri Sharpe

2 ♂, 1 ♀, 1 ♀ juv., Niapu; 2 ♀, Niangara.

Bubo poensis Fraser

2 ♂, 1 ♀, Avakubi; 1 ♂, Medje.

Bubo leucostictus [Temminck] Hartlaub.

1 ♂, Batama (Distr. Stanley Falls); 1 ♀, 1 ♀ juv., Medje. Recorded from Popoi (Aruwimi R.) by Dubois.

Glaucidium tephronotum Sharpe (= *G. pyrausta* Bates)

2 ♂, 1 ♀, Medje; 1 ♀, Nala (Bomokandi).

Otus holerythrus (Sharpe)

1 ♀ juv., Medje. Previously known from Banalia.

Scotelus brunneiceps Sharpe

2 ♂, Avakubi.

Meropogon breweri Cassin

1 ♀, Banalia. Reported from U'bangi R. by Reichenow, and "Province Orientale" by Dubois.

Caprimulgus batesi Sharpe

1 ♂, 1 ♀, 1 ♂ juv., 2 ♀ juv., Medje; 1 ♀, Avakubi. Bannerman¹ has reported it from Poko (Bomokandi).

Chætura cassini Selater

1 ♂, Bengamisa; 3 ♂, 1 ♀, Avakubi; 2 ♂, 1 ♀, Ngayu; 1 ♂, Medje. A single specimen recorded as *C. brevicauda* from Moëra by Sassi, also noted from Aruwimi R. by Reichenow, and from Poko, Uele Distr., by Bannerman.

¹1919, Bull. Brit. Orn. Cl., XXXIX, p. 96.

Centropus anselli Sharpe

1 ♀, Isangi (mouth of R. Lomami).

Verreauxia africana (Verreaux)

1 ♂, Stanleyville; 3 ♂, 3 ♀, 2 ♂ im., 1 ♀ im., Avakubi.

Hirundo nigrita G. R. Gray

1 ♀, Bengamisa; 1 ♂, Banalia; 3 ♂, 2 ♀, 1 ♀ juv., Avakubi; 2 ♀, Gamangui; 2 ♂, Bafwabaka (Nepoko R.); 1 ♂, 1 ♀, Rungu; 1 ♀, Nzoro (Upper Kibali R.). Already reported in 'Vögel Afrikas' from Bafwazabangi, on Ituri R. and from the Aruwimi.

Fraseria ocreata (Strickland)

1 ♂, Avakubi; 1 ♂, Ngayu; 1 ♂, 1 ♀, Gamangui; 1 ♀, 2 ♂ im., Medje.

Fraseria cinerascens Hartlaub

1 ♂, Avakubi.

Lobotus oriolinus Bates

1 ♂, Medje.

Bæopogon clamans (Sjöstedt)

3 ♂, 2 ♀, Avakubi; 1 ♂, 1 ♂ im., Ngayu.

Camaroptera superciliaris (Fraser)

1 ♂, Avakubi; 1 ♂, Penge (Ituri); 1 ♂, Ngayu; 2 ♂, 1 ♀, 1 ♂ im., Medje; 1 ♀ im., Rungu.

Chaunomotus sabinei (J. E. Gray)

1 ♂, Avakubi; 1 ♂ im., Ngayu.

Cinnyris johannæ Verreaux

1 ♂, Dobo (Distr. Bangala); 1 ♂, Avakubi.

Anthreptes aurantium Verreaux

1 ♀, Stanleyville; 1 ♂, Panga (Aruwimi R.); 1 ♂, Bomili (Ituri); 5 ♂, 3 ♀, Avakubi; 1 ♂, 1 ♀, Gamangui; 1 ♂, Gada R. near Niangara (Uele). Ubangi R. and Yambuya on lower Aruwimi mentioned in 'Vögel Afrikas.'

Parmoptila jamesoni (Shelley)

2 ♂, 1 ♀, 3 ♂ im., Avakubi; 1 ♂, Babeyru; 1 ♂, 1 ♀, Gamangui; 1 ♀, 1 ♀ im., Medje. Type locality: Yambuya, lower Aruwimi R.

Hypargos dybowskii (Oustalet)

1 ♀, Faradje; 1 ♂, 2 ♀, Aba (Upper Uele). Type locality: Kemo, Ubangi R.

Estrilda melpoda (Vieillot)

3 ♀, Stanleyville; 2 ♂, 2 ♀, Panga. Recorded from Banalia by Dubois.

Brachycope anomala (Reichenow)

6 ♂, 1 ♀, Avakubi. Type locality: Stanley Falls. Extends up the Aruwimi and Ituri rivers, also down the Congo to Nouvelle Anvers. Recorded by Reichenow¹ from Banalia.

¹1910, Vogelf. Mittelafr. Seengebietetes, p. 326.

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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM COLOMBIA, ECUADOR, PERU, AND BRAZIL

BY FRANK M. CHAPMAN

As a result of studies made at the British Museum in parts of May and June of the present year, the author can now propose definite names for a number of birds which, pending comparison with authentic material, had been provisionally identified.

There are also here included descriptions of apparently new birds discovered by our recent Anthony-Cherrie Expedition to Ecuador, and of a *Leptasthenura* from Peru which I am permitted to name by the authorities of the British Museum. I am under deep obligation to these gentlemen, and particularly Dr. Percy R. Lowe, in charge of the Bird Department, for extending to me every facility to prosecute my labors while the guest of their institution. I wish also to thank Mr. Charles Chubb for his invaluable coöperation.

***Nothocercus fuscipennis*, new species**

SPECIFIC CHARACTERS.—Throat white, forehead russet, as in *N. julius*; back and flanks finely vermiculated, as in *N. nigricapillus*; differing from both *julius* and *nigricapillus* in entire absence of markings on wing-quills.

TYPE.—No. 109,378, Amer. Mus. Nat. Hist.; ♀; Andes west of Popayan, Colombia; alt. 10,340 ft.; July 21, 1911; W. B. Richardson.

DESCRIPTION OF TYPE.—Upperparts and wing-coverts between Prout's and mummy-brown, finely and evenly vermiculated with black, the black markings broader on the rump, upper tail- and greater wing-coverts; anterior half of crown and loreal region russet grading into dark clove-brown very finely and faintly marked with russet on the hind head and cervix; ocular and postocular region with the tawny marks more pronounced; tail dark fuscous with a terminal fringe of the color of the back; wing-quills uniform dark fuscous wholly unmarked; throat and chin snowy white sharply defined from the pale sepia foreneck; rest of underparts mainly ochraceous tawny, the breast darker, the sides, flanks, tibiae and under tail-coverts much like the back and all finely vermiculated with black; feet brownish black; maxilla blackish, mandible Naples-yellow, brownish on its cutting edge and terminally. Wing, 180; tail, 50; tarsus, 61; culmen, 33 mm.

SPECIMENS EXAMINED

Nothocercus fuscipennis.—COLOMBIA: Andes west of Popayan, the type; Prov. of Cauca, 1 (in Brit. Mus.).

Nothocercus julius julius.—COLOMBIA: Bogotá, 3; Laguneta, 1; Almaguer, 1. ECUADOR: Pichincha (Goodfellow), 1 (in Brit. Mus.); 'Ambato,' 1.

Nothocercus julius salvadorii.—The type (in Brit. Mus.) labelled by Verreaux "Equateur" but probably not from Ecuador.

Nothocercus nigricapillus.—BOLIVIA: Locotal, 5800 ft., 1 ♀ im.

Comparison of the single specimen from the Western Andes, provisionally referred to *julius*,¹ with a series of that species representing every age from the lately hatched chick to maturity, convinces me of the specific distinctness of the west Colombian bird. Furthermore, a specimen in the British Museum labelled "Prov. of Cauca," the region whence the supposed new bird comes, shows its characters. Apparently *julius* always has the upperparts broadly barred with black and the outer web of the secondaries marked with cinnamon at all ages, whereas in *fuscipennis* the back is vermiculated, the wing-quills unmarked.

It is important to observe that *julius julius* ranges into Ecuador, a specimen from Pichincha in the British Museum, and one received through Ambato in the American Museum being referable to that species. The Ambato specimen was received in a small collection containing a specimen of *Osculatia sapphirina* and doubtless came therefore from the Amazonian slopes near Baños, perhaps therefore from the same region whence came three females referred by Taczanowski and Berlepsch to *julius* (Proc. Zool. Soc., 1885, p. 112) with the comment that the upperparts are darker, more olive and with broader bars, etc., differences which are shown by our Ambato bird and which may be of racial value.

Specimen "h" of the 'Cat. Birds Brit. Mus.' (XXVII, p. 510) commented upon by Salvadori and later described by Chubb as *Nothocercus julius salvadorii* (1914, Bull. B. O. C., XXIII, p. 95) differs from *julius* in its much more pronounced bars on back and wings, and is certainly not the same as our Ambato bird. It is labelled, evidently by Verreaux, "Equateur" but quite probably did not come from that country since it does not agree with specimens from either the Pacific or Amazonian side of the Andes.

An immature female from Locotal, Prov. Cochabamba, Bolivia, agrees with the description of *Nothocercus nigricapillus* supposed to have come from Chile. If this identification be correct, it affords us a clue to the range of this species.

I append a key to the members of this genus.

Throat white.

Crown wholly plumbeous.....*N. nigricapillus* (Gray).

Crown anteriorly russet.

Back strongly barred.

Secondaries barred only on outer web...*N. julius julius* Bonaparte.

N. julius venezuelensis Cory.

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 190.

- Secondaries barred on both webs.....*N. julius salvadorii* Chubb.
 Back finely vermiculated.....*N. fuscipennis* Chapman.
 Throat ochraceous.
 Throat bright ochraceous.
 Greater under wing-coverts barred.....*N. bonapartei bonapartei* (Gray).
 Greater under wing-coverts not barred...*N. bonapartei frantzii* (Lawrence).
 Throat pale ochraceous; underparts less rufous.
N. bonapartei intercedens Salvadori.

***Penelope barbata*, new species**

SPECIFIC CHARACTERS.—Similar to *Penelope argyrotis* Bonap. but much darker throughout, the chin and upper throat feathered, wholly concealing the skin; whitish margins to feathers gray instead of silvery white and, both above and below, confined to the anterior parts of the body, on the wings appearing only as very slight and inconspicuous markings on the lesser coverts; rump, upper and under tail-coverts and flanks cinnamon-brown instead of Sayal to Mikado-brown.

TYPE.—No. 156,201, Amer. Mus. Nat. Hist.; ♀ ad.; Taraguacocha, Zaruma-Zaraguro trail, Cord. de Chilla, Prov. del Oro, Ecuador; alt. 9750–11,000 ft.; Geo. K. Cherrie.

DESCRIPTION OF TYPE.—Crown and anterior parts of the back very dark olive laterally margined with gray, the forehead, superciliary, cheeks and sides of neck largely grayish; whole orbital region to the base of the bill bare, black in dried skin (blue in life ?); center of back and wings externally uniform shining olive-brown unmarked; rump and upper tail-coverts bright snuff-brown to warm sepia; tail externally like the middle back, lateral feathers black, all tipped with light cinnamon-brown decreasing in extent from without inwardly; chin and upper throat covered with black feathers with a slight mixture of gray posteriorly, concealing the skin; lower throat bare, except for a few short hair-like and slightly pinnate feathers; breast blackish, laterally margined with gray; abdomen light cinnamon-brown faintly vermiculated with blackish; lower tail-coverts darker; tibiae olive-brown, the feathers extending to the proximal third of the tarsus; feet reddish, bill black (skin). Wing, 250; tail, 250; tarsus, 59; culmen, 30 mm.

SPECIMENS EXAMINED

Penelope barbata.—ECUADOR: Taraguacocha, 1, the type; San Lucas, Pacific slope, 2 (Brit. Mus.).

Penelope argyrotis.—VENEZUELA: Merida, 1; Venezuela, 1, type of *P. lichtensteini* (Brit. Mus.). COLOMBIA, 1.

The type of this proposed species agrees with the two San Lucas, Ecuador, skins recorded by Mr. Ogilvie-Grant in the 'Cat. Birds Brit. Mus.,' XXII, p 502 and believed by him to be probably the young of *Penelope argyrotis* of Venezuela. Comparison of the three with two Venezuelan and one Colombian example of that species demonstrates, in my opinion, the specific distinctness of the Ecuadorian form.

***Siptornis wyatti æquatorialis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Siptornis wyatti wyatti* but all the dark areas above, including the central tail-feathers, much blacker, the feathers of the back margined with grayish instead of with brownish.

TYPE.—No. 124,504, Amer. Mus. Nat. Hist.; ♂ ad.; Mt. Chimborazo, Ecuador; alt. 13,000 ft.; July 3, 1913; W. B. Richardson.

SPECIMENS EXAMINED

Siptornis wyatti æquatorialis.—ECUADOR: Chimborazo, 3 ♂, 3 ♀; Cechce, 1 ♂.

Siptornis wyatti wyatti.—COLOMBIA: Paramo of Pamplona, 1 ♂ (type); Paramo of Chiruqua, 1 ♂, 1 ♀; Sierra Nevada of Sta. Marta; alt. 10,000–12,000 ft., 2 ♂, 1 ♀.

I have long suspected that the bird recorded as "*Siptornis wyatti*" from Ecuador probably did not agree with that form but, in the absence of authentic specimens of *wyatti*, it was not possible to reach a satisfactory conclusion in regard to the status of the Ecuador bird. Comparison of Ecuador specimens with the type, and apparently only specimen of *wyatti*, shows the differences given above and a further comparison with material from the Santa Marta group indicates that the bird from that region is essentially identical with *wyatti*. That the differences between the Ecuadorian and Colombian birds are not due to any post-mortem change in the color of the plumage is proven by the fact that one of the Ecuador specimens collected by Stolzmann at Cechce, May 18, 1883, is sufficiently old to be comparable with the type of *wyatti* collected in 1870, and specimens from Santa Marta collected in 1879 and 1881. On the other hand, specimens of *wyatti* collected in the Paramo of Chiruqua, Santa Marta, by Carriker in 1914, are comparable both as to condition of plumage and age of skin with our Ecuadorian series of *æquatorialis*. The Cechce specimen in the British Museum (specimen "f" in 'Cat. Birds Brit. Mus.,' XV, p. 71) above referred to bears the MS. name "*Synall. paramo* sp. n. type de la description pour M. Selater," but I cannot find that this name was published.

***Odontophorus parambæ canescens*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Odontophorus parambæ parambæ* Roths., but prevailing color of the upperparts grayish rather than rich brownish, the black areas smaller, the markings on wing-coverts and tertials buffy rather than ochraceous; size much larger, the bill longer and notably thicker.

TYPE.—No. 156,205, Amer. Mus. Nat. Hist.; ♂ ad.; Alamor, Prov. Loja, Ecuador; alt. 4500 ft.; October 3, 1920; Geo. K. Cherrie.

SPECIMENS EXAMINED

Odontophorus parambæ canescens.—ECUADOR: Alamor, 2 ♂ (inc. type).

Odontophorus parambæ parambæ.—ECUADOR: Esmeraldas, 1 ♂; Naranjo, Prov. Guayas, 2 ♀; near Zaruma, Prov. del Oro, 2 ♂, 1 ♀. COLOMBIA: Barbacoas, 1 ♀; Baudo, Chocó, 2 ♂.

MEASUREMENTS

	Sex	Wing	Tail	Tarsus	Culmen	Depth of Bill at Base
Alamor, Ec.	♂	153	61	36	20.5	13
" "	♂	145	58	38	20	13
Esmeraldas, Ec.	♂	130	..	35	18	11.5
Barbacoas, Col.	♀	135	49	35	18.5	11.5
Baudo, "	♂	130	50	35	18	10.5
Naranjo, Ec.	♀	134	55	38	19	12
Zaruma, "	♂	144	57	37	20	13
" "	♀	144	..	37	19.5	13

Odontophorus parambae occurs in both the Tropical and Subtropical Zones of the Pacific coast of Ecuador and Colombia, from the Peruvian boundary at least to the Chocó. From the last-named region to northern Ecuador it shows no apparent geographical variation. Naranjo specimens are slightly larger while those from near Zaruma exhibit a further approach toward *canescens*, not only in size but in their grayer color. They are, indeed, so nearly intermediate between the small dark northern race and the large pale southern one that it is difficult to say to which they should be referred. Our series therefore indicates the complete intergradation of these two well-marked races.

***Nyctibius longicaudatus chocoensis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Nyctibius longicaudatus longicaudatus*, but general coloration much deeper, the black markings of the upperparts more extensive and more pronounced, the crown largely black, the back and scapulars with sharply defined black shaft-streaks, the brown areas of the upperparts darker, chestnut rather than ochraceous.

TYPE.—No. 111,501, Amer. Mus. Nat. Hist.; ♂ ad.; "testes slightly enlarged"; Nóvita, Rio San Juan, Chocó, Colombia; alt. 400 ft.; December 23, 1911; Allen and Miller.

SPECIMENS EXAMINED

COLOMBIA: Nóvita, 1 ♂ (the type), 1 ♀. BRAZIL: 1. BR. GUIANA: Bartica Grove, 1 ♀. ECUADOR: Sarayaçu, 3.

Comparison of the two specimens of *Nyctibius*, which, for lack of material, I provisionally referred to *longicaudatus* in my paper on Colombian birds,¹ with examples of this species in the British Museum shows, as might be expected, that the bird from the intensely humid Chocó region of Colombia proves to be a well-marked form. The capture

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 272.

of these specimens extends the known range of *Nyctibius longicaudatus* west of the Andes to the Colombian-Pacific Fauna.

***Picumnus parvistriatus*, new species**

SPECIFIC CHARACTERS.—Similar to *Picumnus sclateri* Tacz., but underparts much less heavily marked with black, the breastbars decidedly narrower than the white ones, the streaks of the abdomen and flanks comparatively obsolete; white crown-spots larger.

TYPE.—No. 124,368, Amer. Mus. Nat. Hist.; ♂ ad.; Daule, Prov. Guayas, Ecuador; W. B. Richardson.

DESCRIPTION OF TYPE.—Crown black, the feathers with large rounded tips, yellow on the forehead, white on the remainder of the crown; back pale buffy brown, faintly margined with lighter; tail black, the central feathers white on the inner web; outer feathers with a subapical, diagonal white band; wings fuscous, the inner feathers exteriorly margined with olivaceous; sides of the head white faintly banded with blackish, extending narrowly to the nape; throat and breast banded with black and white, the white bands being pronouncedly broader than the black ones; abdomen and flanks white, narrowly and obscurely striped with blackish; feet and bill blackish. Wing, 52; tail, 25; tarsus, 12; culmen, 12 mm.

DESCRIPTION OF FEMALE.—Similar to male but spots on forehead white instead of yellow. Wing, 51; tail, 24.5; tarsus, 12; culmen, 12 mm.

DESCRIPTION OF IMMATURE.—Similar to the adult female but the crown striped instead of spotted.

SPECIMENS EXAMINED

Picumnus parvistriatus.—ECUADOR: Daule 1 ♂ (type); Manta, Prov. Manaví, 1 ♀; Guayaquil, 1 im.

Picumnus sclateri.—PERU: Paletillas, Prov. Piura, 1 ♂, 2 ♀. ECUADOR: Alamor, Prov. Loja, 4550 ft., 1 ♂ im.; Portovelo, Prov. del Oro, 2000 ft., 1 ♀; Salvias, Prov. del Oro, 3600 ft., 1 ♂; Rio Pindo, Prov. del Oro, 1850 ft., 1 ♂; Santa Rosa, Prov. del Oro, 1 ♀.

The form here described is obviously a representative of *Picumnus sclateri* but the character and extent of its differentiation from that species indicate its specific distinctness. The range of *P. sclateri* appears to be the Tropical Zone of southwestern Ecuador and extreme northwestern Peru. Our eight specimens, which represent the larger part of this area show no racial variation, the most northern being no nearer *parvistriatus* than the most southern. Similarly, our specimens of the last-named form, which inhabits semiarid Ecuador from Guayaquil at least to Manta and probably Bahia de Caraque, are uniform in color.

***Thamnophilus zarumæ*, new species**

SPECIFIC CHARACTERS.—Similar to *Thamnophilus radiatus radiatus* Vieill., but smaller, the male above and below more narrowly barred, the bars obsolete on the nape; forehead with more white, lateral crest feathers with white markings; abdomen

and flanks buffy and comparatively unbarred; inner webs, of all but one outer and two or three inner wing-quills, with even margins instead of spots; under wing-coverts buffy. Female less clearly rufous above than the female of *radiatus*, the nuchal region grayish olivaceous, the sides of the head, especially posteriorly, with little or no buffy wash; the underparts much paler.

TYPE.—No. 129,684, Amer. Mus. Nat. Hist.; ♂ ad.; Zaruma, Prov. del Oro, Ecuador; September 17, 1913; W. B. Richardson.

DESCRIPTION OF MALE.—Cap black, the forehead thickly spotted with white, all but the central feathers of the elongated crown feathers spotted with white on one or both webs; nape blackish, barred or spotted with white, the post-nuchal region grayish, the bars obsolete; back with black and white bars, the former the wider; upper tail-coverts tipped with buffy; tail black with a subterminal white bar, on at least the central feathers, and broken white bars on both webs of all of them; wings black, the outer webs of the feathers with white spots, not reaching to the shaft, the secondaries and tertials tipped with white, the latter marked with white on both webs; the inner margins of secondaries and all but outer primary, with even, well-defined white margins, which, on the inner secondaries, reach the white terminal margin and, basally, the shaft of the feather; upper wing-coverts subterminally barred, and laterally spotted with white; under primary-coverts white narrowly tipped with black, under secondary coverts buffy; sides of the throat striped black and white, lores and auriculars grayish white; throat white faintly streaked with black; breast and sides white narrowly and not continuously barred with black; abdomen centrally white becoming buffy posteriorly and on the flanks and under tail-coverts; the bars on the abdominal region obsolete or wanting; tibiae barred with black and white; feet blackish, bill blackish, tomiae and mandible horn-color. Wing, 66–69; tail, 64–67.5; exposed culmen, 15–17 mm.

DESCRIPTION OF FEMALE.—Crown rufous-chestnut; forehead buffy, chiefly basally; anteorbital region pale buffy; post-orbital region whitish striped with black; back hazel, grayish olivaceous anteriorly with an ill-defined grayish nuchal band; tail deep ferruginous-hazel; wings blackish, exteriorly like the tail, internally margined with ochraceous-buff, the inner feathers sometimes obsoletely barred; upper wing-coverts like the tail, darker centrally and with a paler subterminal band and narrow black margin; under wing-coverts ochraceous-buff; throat whitish, obscurely streaked; rest of underparts ochraceous-buff, darker on the flanks and ventral region, paler centrally; the breast with a faint suggestion of dusky bars; feet and bill as in the male. Wing, 64–70.5; tail, 62.5–71; exposed culmen, 16–18 mm.

SPECIMENS EXAMINED

Thamnophilus zaruma.—ECUADOR: Zaruma, 6000 ft., 2 ♂ (inc. type), 4 ♀; Portovelo, 2000–2700 ft., 5 ♂, 3 ♀; Rio Pindo, 1850 ft., 1 ♀; Punta Santa Ana, Prov. del Oro, 4000 ft., 1 ♂, 2 ♀; Celica, 6900 ft., Prov. Loja, 1 ♀; Alamor, Prov. Loja, 4350 ft., 1 ♂, 1 ♀. PERU: Milagros, 2200 ft., Prov. Piura, 1 ♂.

Thamnophilus radiatus albicans.—COLOMBIA: Bogotá region, 9 ♂, 8 ♀.

The discovery of a representative of *Thamnophilus radiatus* on the Pacific coast of southwestern Ecuador is of exceptional faunal interest. No other form of this group is known from either western Ecuador or western Colombia and the species here described falls into

the list of species represented at the eastern and western bases of the Ecuadorian Andes, with no connection of range. The new bird also adds one more species to the list of those restricted to southwestern Ecuador and the immediately contiguous part of Peru.

The abundance and nature of my material proves beyond question that the characters which distinguish this proposed new form are not attributable to immaturity and the characters themselves are obviously of specific value.

THE STRIPE-BACKED MEMBERS OF THE GENUS *Leptasthenura*

Comparison of the specimen of *Leptasthenura*, provisionally referred to *pileata* Sel. in Bull. 117 U. S. Nat. Mus., p. 82, with the type of that species shows at once that the Torontoy bird is specifically distinct, and I therefore describe it below.

Leptasthenura xenothorax, new species

SPECIFIC CHARACTERS.—Most nearly related to *Leptasthenura pileata* Sel., but hazel-rufous of crown extending to interscapulars; a pronounced white postocular stripe; back much blacker, shaft-streaks whiter and narrower; throat conspicuously black and white, the sharply contrasting black margins of the feathers separated by the basal white, reaching along the shaft to the tip of the feather; remainder of underparts gray, unmarked and clearly defined from the throat area.

TYPE.—No. 273,010, U. S. Nat. Mus.; ♂ ad.; Torontoy, Urubamba Valley, Peru; alt. 14,100 ft.; May 14, 1915; E. Heller.

DESCRIPTION OF TYPE.—Entire crown and nape uniform hazel-rufous, unstreaked; lores blackish; postocular stripe white; center of back black with sharply defined white shaft-streaks; back anteriorly brown; the shaft-streaks more rufous and less clearly defined; tail blackish, the three outer feathers with grayish ends decreasing in extent from without inwardly; wings blackish; their coverts, inner quills, median portion of the external web of the inner primaries and basal portion of the external web of the secondaries cinnamon-buff; throat and sides of the neck conspicuously jet black and snowy white, the sharply contrasting black margins of the feathers separated by the arrow-shaped white area, the point of which extends along the shaft to the tip of the feather; remainder of the underparts uniform smoke-gray with a drab tint. Wing, 66; tail, 77; tarsus, 21; culmen, 10 mm.

I found also in the British Museum a specimen of what is evidently *Leptasthenura striata* Ph. and Land., from Iquique not far south of Arica, the type locality of this apparently rare and little known species. A specimen in the American Museum, collected by Beck at Lima, is apparently also to be referred to *striata* though it was not compared with the Iquique example. Compared with the latter, the type of *pileata* has the crown solid rufous unstriped, the shaft-streaks of the back and throat-spots more pronounced, the breast and belly dusky olive, the former with broad, the latter, with narrow but well-defined central streaks.

Four specimens in the British Museum, collected by Baron in the Temperate Zone of northern Peru, apparently represent *striata*, the coastal form, but are at least subspecifically and perhaps specifically separable from it. I suggest for this apparently undescribed form the name

***Leptasthenura striata cajabambæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Leptasthenura striata striata* Ph. and Landb. of northern Chile, but rufous of crown deeper, dorsal stripes whiter, throat-spots more numerous and more pronounced. Wing-quills and coverts margined with grayish instead of cinnamon; cinnamon band at base of inner quills much narrower and paler; margins to tail feathers grayer.

TYPE.—Registry No. British Museum, 99-6, 1, 81; ♀; Cajabamba, Peru; alt. 9500 ft.; March 28, 1894; O. T. Baron.

SPECIMENS EXAMINED

Leptasthenura xenothorax.—PERU: Torontoy, the type.

Leptasthenura pileata.—PERU: Andes of Lima (type, Brit. Mus.).

Leptasthenura striata striata.—CHILE: Iquique, 1 (Brit. Mus.). PERU: Lima, 1 ♂ (Amer. Mus.). These two specimens were examined independently.

Leptasthenura striata cajabambæ.—PERU: Cajabamba, alt. 9500 ft., 1 ♀ (type, Brit. Mus.); Cajamarca, alt. 10,000 ft., 2 ♂; Huamachucho, 1 ♀.

The specimens on which this well-marked form is based were identified by Salvin as "*Leptasthenura pileata* Sel." (1895, Nov. Zool. II, p. 121). They differ, however, from that species in their striped crown and other characters.

The members of the genus *Leptasthenura* having the back streaked constitute a closely related group confined to the Andean Paramo, or Puna Zone, and to that portion of the Pacific coast washed by the Humboldt Current. So far as known, the group includes four species and four subspecies which may be diagnosed as follows:

Crown streaked.

Breast streaked.

Ecuador and Central Andes of Colombia (type locality, Panza, Ec.).

L. andicola andicola Selater.

Peru (type locality, La Raya, south of Cuzco). *L. a. peruviana* Chapman.¹

Colombia (type locality, Paramo of Macotama, Sierra Nevada of Santa Marta). *L. a. extima* Todd.²

Colombia (type locality, Lagunillas, Boyaca). *L. a. exterior* Todd.³

¹1919, Bull. Amer. Mus. Nat. Hist., XLI, p. 327.

²1916, Proc. Biol. Soc. Wash., XXIX, p. 97.

³1919, Proc. Biol. Soc. Wash., XXXII, p. 115.

Breast not streaked

Wings externally margined with grayish.

Peru (type locality, Cajabamba). *L. striata cajabambæ* Chapman.

Wings externally margined with cinnamon.

Coasts of northern Chile, and Peru (type locality, Arica). *L. striata striata* Philippi and Landbeck.

Crown not streaked.

Lower parts streaked.

Peru (type locality, Andes of Lima). *L. pileata* Sclater.¹

Lower parts not streaked.

Peru (type locality, Torontoy, Urubamba Cañon). *L. xenothorax* Chapman.

***Automolus celicæ*, new species**

SPECIFIC CHARACTERS.—Not closely related to any recognized species of *Automolus*; possibly nearest *A. cervinigularis* but feathers of the crown less elongate and browner; underparts streaked, etc.; with a general resemblance to *Philydor temporalis* Scl., but bill much larger. Crown Brussels-brown instead of olive; throat washed with buff, sides of the neck clear ochraceous orange.

TYPE.—No. 22,115, Amer. Mus. Nat. Hist.; ♂ ad.; Celica, Prov. Loja, Ecuador; alt. 4550 ft.; September 25, 1920; George K. Cherrie.

DESCRIPTION OF MALE.—Upperparts ochraceous-tawny, whole crown slightly darker, Brussels-brown; a pronounced superciliary ochraceous-buff anteriorly, becoming ochraceous orange posteriorly where it meets the clear ochraceous orange of the sides of the neck and ill-defined nuchal band; anteorbital and postauricular regions grayish; tail clear, uniform, deep hazel; wings externally like the back; the quills blackish on the inner web margined with rich ochraceous buff; under wing-coverts ochraceous orange; throat buff to antimony-yellow, its sides and a suggestion of a gular band ochraceous orange; remainder of underparts isabella more tawny olive or tawny on the flanks; the breast-streaks like the color of the throat; lower tail-coverts cinnamon-rufous; feet blackish; maxilla blackish; mandible horn-color, except on tip and cutting edge. Wing, 85–89; tail, 73–78; culmen, 21.5–23 mm.

DESCRIPTION OF FEMALE.—Resembling the male in color but somewhat smaller in size. Wing, 80–84; tail, 69–75; culmen, 22 mm.

SPECIMENS EXAMINED

Automolus celicæ.—ECUADOR: Celica, 6 ♂ (inc. type), 2 ♀; Alamor, 2 ♀; Guachumaná, 4050 ft., 1 ♂.

Philydor temporalis.—ECUADOR: Pallatanga, the type; Alamor, 4550 ft., 1 ♀; El Chiral, 5350 ft., 1 ♀.

The discovery of this distinct species in the Alamor region further emphasizes the faunal characteristics of the southern end of the Pacific Subtropical Zone of Ecuador. In the character of its bill and feet *Automolus celicæ* agrees with other members of this genus, in its shorter,

¹1863, Arch. für Naturg., I, p. 119.

crown-feathers it is like the species of the genus *Philydor*, while in general coloration it more nearly resembles *Philydor temporalis* than any other species known to me.

***Pachysylvia fuscicapilla albigula*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *P. f. fuscicapilla* (Scl. and Salv.) but throat dusky white well defined from yellowish of the remaining underparts which are paler and less uniform than in *fuscicapilla*, the median line being whitish; upperparts as in *fuscicapilla*, the bill shorter; with a general resemblance to *P. semibrunnea* but smaller and with a shorter bill, the crown Saccordo's umber rather than hazel, this color extending further on the back; the breast without the buffy wash usually present in *semibrunnea*, the underparts with more yellow, the wing-coverts greener and nearly uniform without the narrow yellowish margin of *semibrunnea*. Wing, 56; tail, 41.5; culmen, 13 mm.

TYPE.—No. 11,033, Museum Goeldi; ♀; Sta. Julia, Rio Iri (branch of the Xingu), Brazil; April 17, 1914; Emilia Snethlage.

SPECIMENS EXAMINED

Pachysylvia fuscicapilla albigula.—BRAZIL: Rio Iri, the type; Sta. Helena, Rio Jamauchim (branch of the Tapajoz), 1 ♂.

Pachysylvia fuscicapilla fuscicapilla.—ECUADOR: Sarayacu, 3 (inc. type; Brit. Mus.).

Pachysylvia semibrunnea.—COLOMBIA: Miraflores, Cen. Andes, 3 ♂, 1 ♀, 1 ?; Palmira, 1 ♀ ?; Aguadita, 1 ♂; 'Bogotá,' 1.

This proposed form is based on two birds contained in a small collection forwarded by Dr. Snethlage of the Goeldi Museum, identification of which was deferred pending examination of specimens in the British Museum.

***Basileuterus fraseri ochraceicrista*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Basileuterus fraseri fraseri* Scl., but with the center of the crown ochraceous-orange instead of lemon-chrome slightly tipped with chestnut.

TYPE.—No. 120,138, Amer. Mus. Nat. Hist.; ♂ ad.; Chone, Manaví, Ecuador; December 16, 1912; W. B. Richardson.

SPECIMENS EXAMINED

Basileuterus fraseri ochraceicrista.—ECUADOR: Chone, 2 ♂ (inc. type), 2 ♀; Guayaquil, 1 ♂; Puno Is., 1 ♀; Balzar, 2; Santa Rita, 1; Babahoyo, 1 (int.); Naranjito, 2 (int.).

Basileuterus fraseri fraseri.—ECUADOR: Pallatanga, 1 (the type); Prov. del Oro, Santa Rosa, 3 ♂, 2 ♀, 2 ?; Zaruma, 1 ♂; Portovelo, 2 ♂, 5 ♀, 1 ?; El Chiral, 5350 ft., 1 ♂, 1 ♀; Salvias, 3600 ft., 1 ♀; Alamor, Prov. Loja, 4550 ft., 2 ♂, 1 ♀.

Although the differences between the two races of *fraseri* here recognized might, at first glance, be considered attributable to age or

individual variation, the large amount of material examined and the fact that apparently a definite range can be given to each form, convinces me of their racial distinctness.

The yellow-crowned bird (*fraseri*) occurs in the humid forested region east of Puna Island and is found in the Subtropical as well as Tropical Zone. In the first-named zone it extends at least as far north as Pallatanga. The ochraceous-crowned bird (*ochraceicrista*) occupies the semiarid Tropical Zone from Puna Island and, on the mainland, from Guayaquil north to the Province of Manaví. Two specimens from Naranjito on the Guayaquil and Quito R. R., just west of Bucay where the continuous forest begins, are intermediate, the yellow bases to the coronal feathers being only partly, instead of wholly concealed by their ochraceous-orange tips.

***Sporophila insulata*, new species**

SPECIFIC CHARACTERS.—Resembling *Sporophila minuta*, but rump largely gray, only the most posterior feathers being chestnut, the tail-feathers basally white.

TYPE.—No. 118,142, Amer. Mus. Nat. Hist.; ♂ (ad. ?); Tumaco, southwestern Colombia; July 28, 1912; W. B. Richardson.

DESCRIPTION OF ADULT (?) MALE IN WORN PLUMAGE.—Upperparts, including upper tail-coverts, mouse-gray, only the terminal feathers of the rump rufous-chestnut; tail black, white at the base, white on the outer feathers much reduced or absent; wings black, secondaries white for basal half, all but two outer primaries basally white, increasing in extent inwardly; underparts rufous-chestnut, the abdomen mixed with whitish (indicating immaturity ?); the lower tail-coverts chestnut; bill and feet blackish. Wing, 50; tail, 36; culmen, 9.3 mm.

DESCRIPTION OF IMMATURE MALE IN WORN PLUMAGE.—Similar to adult, but abdomen and under tail-coverts white.

DESCRIPTIONS OF FEMALE IN WORN PLUMAGE.—Resembling female of *S. minuta* in comparable condition, but somewhat grayer above and paler below and with more white at the bases of the wing-quills. Wing, 48; tail, 36; culmen, 9.3 mm.

SPECIMENS EXAMINED

Sporophila insulata.—COLOMBIA: Tumaco, 1 ad. ♂ (type), 2 im. ♂, 1 ♀.

Sporophila minuta.—A large series from Nicaragua to Panama, Colombia, Venezuela, Trinidad and Brazil.

While apparently a representative of *Sporophila minuta*, the bird here described evidently deserves full specific rank. It is known as yet only from the island of Tumaco, but whether an island form or not, it appears to be insulated from its nearest relative, since our researches have thus far failed to discover any other representative of *Sporophila minuta* on the coasts of either Colombia or Ecuador.

NEW MAMMALS FROM BRITISH GUIANA AND COLOMBIA

BY H. E. ANTHONY

Through an arrangement with Mr. William Beebe, Director of the Tropical Research Station of the New York Zoological Society, The American Museum of Natural History has been receiving collections of mammals made in British Guiana, where the station is located. A report upon the combined collections is in process of preparation, but four new forms have been found and are described in this preliminary paper. In addition the description of a new rodent, of the genus *Dinomys*, from Colombia is included.

***Tayassu pecari beebei*, new subspecies**

TYPE.—No. 42408, Amer. Mus. Nat. Hist.; Kartabo, British Guiana; June 11, 1919; collector Wm. Beebe. The type is an adult female, with skull.

GENERAL CHARACTERS.—Closely related to *pecari pecari*, but differing in the extent of white on the snout and lower jaw.

DESCRIPTION.—Coloration about as in *p. pecari* but white of face and throat markings more yellowish; long hairs of upper parts brownish black; snout, above, only slightly lighter in color than rest of upper parts and not with strongly contrasting whitish of *p. pecari*; chin and throat patch restricted and not in such marked contrast to the surrounding areas; feet dark to hoofs. Skull as in *p. pecari*.

MEASUREMENTS.—Taken from animal in the flesh: total length, 1090 mm.; tail vertebrae, 60; hind foot, 224; weight, 80 pounds.

There are five specimens in the Kartabo series, two males and three females, and in no one of them is there the extensive face and throat patch seen in *p. pecari* collected at Porto Campo, Brazil. In all of them this area is noticeably less extensive and markedly more yellowish. The only specimen with the legs entire shows none of the whitish markings seen in *p. pecari* just above the hoofs. The Kartabo animal gives a strong impression of being unicolor and is not as contrastingly marked as the animals from Brazil.

Although the material for comparison is rather inadequate to show detailed differences, there being only three adult specimens of *p. pecari* from Brazil at hand, the color differences alone appear to be ample for the separation of a new race, which is named in honor of Mr. William Beebe, the director of the Tropical Research Station in British Guiana.

The series of *p. pecari*, collected in Colombia, Santa Marta district, and identified by Dr. J. A. Allen,¹ appear to be more or less intermediate

¹1904, Bull. Amer. Mus. Nat. Hist., XX, p. 427.

between true *pecari* and *p. beebei*, resembling the Brazilian series rather more than the specimens from Guiana.

With regard to the subspecies of *pecari* described from Ecuador by Lönnberg¹ as *æquatoris*, I am unable to state the characters by which it and the Guiana specimens may be differentiated, since I have not seen *æquatoris*, but the two races are separated by almost the width of a continent and the high ranges of the Andes, and it is unlikely that the two will prove to be identical. Lönnberg's type is an animal too young to reveal characters that may be accepted with certainty as those of an adult, and the restriction of the white snout and throat markings, in which it agrees with *beebei*, may well be one of the characters of immaturity.

Specimens of *pecari* obtained from the headwaters of the Rio Napo, in Ecuador, just east of the type locality of *æquatoris*, but across the Andes, certainly do not resemble *beebei* very closely in external characters.

NUMBER OF SPECIMENS.—Eight, 7 skins, 7 skulls, 2 skeletons, from Kartabo.

MEASUREMENTS OF SKULLS OF *Tayassu pecari pecari* AND *T. p. beebei*.

	Total Length	Basal Length	Zygomatic Breadth	Post-orbital Breadth	Upper Molar Series
<i>T. p. beebei</i>					
No. 42408 ♀ type	293	245	121	95	85
42409 sex?	300	250	124	100	79
42410 ♂	281	241	125	91	81
48366 ♀	273	230	120	87	74
<i>T. p. pecari</i>					
Average of 9 skulls from Santa Marta, Colombia	260	227	111	88.7	77
<i>T. p. pecari</i> —Brazil					
36655 ²	270	226	111	79	76
36656	280	235	114	91	80
36657	287	236	120	93	82

¹1921, Arkiv. för Zool. Stockholm, XIV, No. 4, p. 56.

²Last molar just through gum.

Pecari tajacu macrocephalus, new subspecies

TYPE.—No. 48366, Amer. Mus. Nat. Hist., old ♀, skin and skull; Kartabo, British Guiana; August 26, 1920; collector Wm. Beebe.

GENERAL CHARACTERS.—Similar to *tajacu* but with skull larger and markedly different in structure.

DESCRIPTION.—Pelage about as in *tajacu*, grizzled yellowish and black, with black dorsal area; collar fairly well outlined.

Skull larger than that of *tajacu*, with more massive build, the forward extension of the zygomatic flange continued to canine alveolus and forming a heavy rostrum; outline of entire skull noticeably subtriangular viewed either from above or below, due to extended zygomatic flange; palate throughout anterior portion wider than distance across the molar series of that portion.

MEASUREMENTS.—Taken in the flesh: total length, 948 mm.; length of hind foot, 195.

The Guiana collared peccary differs so from the collared peccary of Brazil and from *torvus* of Colombia that it is necessary to give it a new name. The skins of the new subspecies are not unlike those of either neighbor but the series of skulls shows differences too great and too constant to be overlooked. The subtriangular outline of the skull of *macrocephalus* is so unlike the outline of the skull of Brazilian *tajacu*, which is flask-like, that by this character alone the Guiana animal may be easily differentiated. There is an approach to this condition seen in the skulls of *torvus* from the Santa Marta district of Colombia but it is not so conspicuous. In *macrocephalus* the rostrum just anterior to the orbits is especially widened and built out. As may be noted from the table of measurements, the skulls of the new subspecies are larger than those of either *tajacu* or *torvus*.

The character of the anterior lower molar, given by Bangs in his description of *torvus*,¹ appears to have little value in separating *torvus* from *tajacu*, since in the series of skulls of these two forms now in the Museum's collection there are individuals of *tajacu* which have this tooth with the anterior tubercle two-lobed (a condition said by Bangs to be found only in *torvus*) and there are individuals of *torvus* having the tooth with the tubercle entire.

In the belief that more material from northeastern South America will eventually show *torvus* to be a subspecies of *tajacu*, I have made the Guiana animal a subspecies of *tajacu*, although it resembles *torvus* fully as much as it does *tajacu*.

NUMBER OF SPECIMENS.—Eight, as follows: Kartabo, 3 skins, 5 skulls; Kalacoon, 2 skins, 1 skull.

¹1898, Proc. Biol. Soc. Wash., XII, p. 164.

MEASUREMENTS OF SKULLS OF *P. t. macrocephalus*, *P. torvus*, AND *P. t. tajacu*.

	Greatest Length	Basal Length, foramen magnum to incisors	Zygomatic Breadth	Postorbital Breadth	Breadth of Rostrum	Depth of Occiput	Length of Upper Molar Series	Greatest Length of Mandible	Length of Lower Molar Series
<i>macrocephalus</i>									
41937	245	205	111	89	40	83	69	176	72
42407	256	208	109	77	38	89	67	177	71
48145	247	207 ³	109	82	39	82 ³	67	171	71
48223	246	203	104	77	39	88	64	174	71
48366 ¹	250	201	106	74	37	85	63	172	69
<i>torvus</i>									
14677 ²	240	197	103	75	41	82	67	168	74
<i>tajacu</i>									
330 ²	236	189	108	71	38	85	65	168	70

***Æcomys rutilus*, new species**

TYPE.—No. 42910, Amer. Mus. Nat. Hist., ♀ ad.; Kartabo, British Guiana; June 27, 1920; collector Wm. Beebe. The type is a skin with skeleton.

GENERAL CHARACTERS.—A small, brightly colored species, with very short tail and clear white under parts.

DESCRIPTION.—Color above, between amber-brown and hazel (Ridgway), darkest along dorsal area and on crown, the hairs slaty black for basal two-thirds; below, clear white, the hairs white to the base; hands and feet dirty white, almost dusky; dark orbital ring with small dark area at posterior corner of eye; tail brownish, unicolor. Skull small and broad, rostrum very short, zygomata flaring, a low supra-orbital beading.

MEASUREMENTS.—Taken in the flesh: total length, 171 mm.; tail vertebrae, 94; hind foot, 20. Greatest length of skull, 24.2; zygomatic breadth, 13.5; length of nasals, 7.7; interorbital breadth, 4.4; breadth of brain-case, 11; palate, to incisors, 10; palatal foramina, 3.7×2.2; length upper molar series, 3.4.

Compared with *Æcomys nitedulus*, collected at the same place, Kartabo, *rutilus* is somewhat smaller superficially, much brighter in color, with longer, softer, pelage, shorter tail and conspicuously smaller skull. It is possible that its relationships are with *rosilla* of Thomas, which is said to be a small, richly colored form, with a short tail.⁴ However, it is not identical with *rosilla* since it is even smaller in size and has the under parts white instead of ochraceous.

¹Type.

²Selected skull, the largest in the series.

³Only approximate since condyles are broken.

⁴1904, Ann. and Mag. Nat. Hist., (7) XIV, p. 35, July.

***Echimys longirostris*, new species**

TYPE.—No. 42886, Amer. Mus. Nat. Hist., sex indet.; Kartabo, British Guiana; July 26, 1920; collector Wm. Beebe. The type is an adult, teeth well worn, skin with skeleton.

GENERAL CHARACTERS.—Most like *armatus*, but differing in characters of pelage and in significant details of cranial structure, having much longer nasals and shallow postpalatal notch.

DESCRIPTION.—Pelage spiny, but with many unmodified hairs which partially mask the spines; hairs on crown only slightly spinous; color above, a mixture of black, ochraceous and buff, the ochraceous strongest on nose and face and posterior to shoulders along dorsal area; black strongest on neck and shoulders; flanks lighter than dorsal area and merging insensibly into the grayish under parts; hairs of underparts subspinous, gray at base and tipped with buff; pectoral area more brightly colored than posterior under parts; hands and feet grizzled gray, buff and ochraceous, dirty white distally; tail haired at base for about 50 mm., colored same as rump, scaly for rest of its length, sparsely haired, practically unicolor, ashy in color.

Skull elongate with convex superior outline; nasals long, slender, subcylindrical; lateral margins of temporals forming straight lines, not concave; postpalatal notch U-shaped, reaching scarcely beyond posterior margin of last molar; molar pattern typical of the genus.

MEASUREMENTS.—Taken from dried skin; total length, 466 m.; tail vertebræ, 225; hind foot, 38.

Reluctant as I have been to describe a new *Echimys* from a region already well supplied with names, I have been unable to reconcile the obvious characters of this specimen with those of *armatus* (= *guianæ* = *castaneus*). Aside from the differences in the character of the pelage (its apparently less spinous quality and the minor color differences), for which it might be remotely possible to account by consideration of the state of wear and the season, the cranial differences are too profound to be called individual variation. Eleven skulls of *Echimys* from the island of Trinidad, *castaneus* (= *guianæ* = *armatus*), of varying ages and a Demerara example of *armatus*, identified in the British Museum and received in an exchange from there, show complete accord with one another, in cranial characters with only very slight proportional variations. The skull of the new species is radically distinct from all of these skulls in the much longer nasals, the straight and not concave supra-orbital border, and the shallow postpalatal notch.

A careful search of the literature showing figures of *Echimys* skulls from northeastern South America has failed to disclose any examples with the characters above noted.

Only the one specimen of *longirostris* was collected.

MEASUREMENTS OF SKULLS OF *Echimy's longirostris* AND *E. armatus*.

	Greatest Length	Length of Nasals	Zygomatic Breadth	Least Inter-orbital Breadth	Breadth of Brain-case	Depth of Rostrum	Length of Palate	Alveolar Length of Upper Molar Series
<i>longirostris</i> 42886 type	56.5	19.3	26.3	14.2	21.3	11.4	23.7	11.7
<i>armatus</i> —Trinidad 4727	55.7	16.8	25.4	12.5	21	10.1	21.3	12.1
4728	55.8	15.9	25.8	13	21.3	10.6	21.8	11.9
4944	51.4	15.8	24.6	12	20.3	9.6	19.8	11.5
4946	53.1	15.9	24	11.9	19.8	10	20.3	11.3
6092	56	17.2	26.2	12.8	21.8	10.3	21.8	11.9
Demerara 36495	51.6	15	24.4	12.5	19.7	9.8	21	12.5

***Dinomys gigas*, new species**

1916. *Dinomys branickii* Allen, Bull. Amer. Mus. Nat. Hist., XXXV, p. 206, May 31, 1916.

TYPE.—No. 33913, Amer. Mus. Nat. Hist., La Candela, Huila, Colombia; altitude, 6,500 ft. The specimen is a flat hunter's skin, purchased by Mr. Leo E. Miller, of the Museum's expedition to Colombia, in 1912. It has no skull and there are no flesh measurements, while the skin lacks the tail and all four feet. Mr. Miller believed that the animal was killed near La Candela, where the hunter himself lived.

GENERAL CHARACTERS.—A very large species, heavily striped and with strongly contrasting pattern of black and white.

DESCRIPTION.—Color above, black, grizzled and striped with white; head a grizzled gray, neck to shoulders with less white; shoulders to base of tail with four heavy white stripes, continuous except at their extreme posterior end; flanks from fore to hind legs almost clear white, except that the dark bases of the white hairs show through to give a grizzled effect; legs and under parts similar to flanks; hair quite long everywhere.

MEASUREMENTS.—Length of flat skin, tip of nose to base of tail, 750 mm.

At the time that this specimen was identified by Dr. Allen, *loc. cit.*, as *branickii*, the Museum had no other specimens of *Dinomys*, and the identification was based upon the description by Peters.¹ Although the agreement was not very close, it was thought inadvisable to attempt description of a new form with such inadequate material. Now the Museum has two additional specimens of *Dinomys*, typical *branickii* from the Museu Goeldi at Para and *branickii occidentalis* from the Western Andes of Ecuador, while I have seen other specimens of *b. occidentalis* in the collection of Mr. Ludovic Soderstrom at Quito. Upon the basis of this material, it appears quite evident to me that the Colombian *Dinomys* can not be *branickii*, nor do I believe it to be a subspecies of it.

Aside from the difference in color between the Colombian skin and the specimen of *branickii*, which is dark brown, there is a marked difference in the color pattern. The specimen from Ecuador is more like the Candela skin in color but here too the difference in pattern exists. The new species has heavy continuous white stripes, averaging 10 mm. wide, of solid white hairs, while the stripes in both *branickii* and *occidentalis* are interrupted and more a series of semi-connected spots. The long hairs of the flanks form a much whiter covering than in the two known forms. The pelage of *gigas* is noticeably longer than that of the other specimens of *Dinomys* in the collection but whether this is seasonal, individual, or of specific character it would be difficult to say.

Although the flat skin may have been considerably stretched in preparation, it is so much larger than the skins of *branickii* and *occidentalis*, which measure a full fifty per cent less in total length, that the conclusion as to the greater size of *gigas* is unavoidable.

¹1873, Monatsb. k. p. Acad. Wissensch. Berlin, p. 552.

PRELIMINARY REPORT ON ECUADOREAN MAMMALS. NO. 1

By H. E. ANTHONY

Field work done by The American Museum of Natural History in Ecuador in 1920 and 1921 has resulted in the acquisition of more than 900 mammals, to which was added, by purchase and as gifts from Mr. Ludovic Soderstrom of Quito, more than 600 mammals, making a collection which aggregates about 1550 specimens. Using this collection as a nucleus, it is planned to send out additional expeditions¹ and eventually to issue a report in full on the Mammals of Ecuador. From time to time preliminary reports will be published in order to place on record any forms new to science. The following is the first of these reports.

Ichthyomys tweedii, new species

TYPE.—No. 47798, Amer. Mus. Nat. Hist., ♂; Portovelo, Prov. del Oro, Ecuador; altitude, 2000 ft.; July 16, 1920; collector, H. E. Anthony. The type is a skin with skeleton.

GENERAL CHARACTERS.—A very large species, differing from the known forms of *Ichthyomys* in size and in cranial characters.

DESCRIPTION.—

Color above, a mixture of black, gray, and buff, the general impression being a grizzled brown; below, white, the plumbeous under-fur showing through to a slight extent; pelage throughout of two types of hair, the long, hard hairs and the soft, short under-fur; tail practically unicolor, slate black, rather densely haired.

Skull heavily built and strong, much larger than the skull of *soderstromi* or of *stolzmanni*; malar apparently absent; nasals tapering to a point posteriorly; rostrum very broad; a marked interorbital construction; zygomatic root of squamosal strongly developed; dentition essentially as in other species of *Ichthyomys*.

MEASUREMENTS.—Taken in the flesh: total length, 317 mm.; tail vertebrae, 150; hind foot, 36. See table on page 4 for measurements of skull.

Tweedii is so distinct from the other species of *Ichthyomys* that it may be advisable to erect for it a new subgenus. As only one specimen was taken, I have been loath to do this, since some of the characters may be, in part, individual. The Portovelo specimen is so much larger that it is not approached by the largest of a series of seven typical *soderstromi* from near Quito, while the size of the skull may be readily noted from the table of measurements.

¹A party whose members left New York in June and July, 1921, is now in Ecuador.

The wide rostrum, and rather flaring zygomatic arches, differentiate *tweedii* from either *soderstromi*, *stolzmanni* or *hydrobates*, while the areas for muscle attachment upon the frontals and parietals are so well marked as to indicate an animal of much greater strength. In the character of the heavy rostrum, *tweedii* is nearer to *stolzmanni* and *hydrobates* than it is to *soderstromi*, since the latter has the slenderest rostrum of the group.

The type specimen was brought in to me by a boy who caught it near his mother's house, near the banks of the Rio Amarillo. Although traps were set out for *Ichthyomys* in every suitable locality throughout the work in southern Ecuador, no additional specimens were secured. It is rather significant to note the low elevation at which this animal was taken, only 2000 feet above sea-level, as compared with the elevations at which the other species have been found, about 9000 feet in Peru and northern Ecuador, about 4000 feet in Merid , Venezuela.

I take pleasure in naming this fine species in honor of Mr. A. M. Tweedy, the resident manager of the mine at Portovelo, who extended to the Museum's expedition all the assistance it lay in his power to give.

NEUSTICOMYS, new genus

GENOTYPE.—*Neusticomys monticolus*, new species.

GENERAL CHARACTERS.—Allied to *Ichthyomys*, *Rheomys*, and *Anatomys*, from each of which it differs in the greatly reduced hallux and in the character of the dentition.

DESCRIPTION.—Size small, fur very soft and close, with scattering of longer, outer hairs; hind foot least specialized of the group for aquatic life, hallux not extending beyond tubercle at base of adjacent digit; skull smooth and typically cricetine, without upturned nasals, incisors showing little specialization; infraorbital foramen large; supraorbital foramina laterally placed; palatal foramina very long, extending from molar toothrow almost to incisors; molars essentially as in *Ichthyomys* but last lower molar with single cusp instead of two.

Neusticomys monticolus, new species

TYPE.—No. 46574, Amer. Mus. Nat. Hist., ♀ ad.; Nono Farm, "San Francisco," near Quito, Ecuador; February 16, 1916; collector, Ludovic Soderstrom. The type is a skin, in excellent condition, and a skull.

GENERAL CHARACTERS.—Superficially most like *Rheomys* in color, character of fur, and size, but with greatly reduced hallux; noticeable external ear, naked median line from nostrils to upper lip, and very soft fur.

DESCRIPTION.—

Color above, uniform clove-brown (Ridgway), the hairs blackish plumbeous at the base; below, lighter with irregular washing of pale smoke-gray along the median area and a small ivory-yellow pectoral spot; feet soiled whitish; tail above and below like back but with a faint sprinkling of whitish hairs, especially along under surface.

Skull compressed, with broad flat braincase, smooth, without ridges on frontals or parietals, a scarcely perceptible depression at base of nasals, but plane of nasals continuous with that of frontal area; rostrum slender; zygomatic arch threadlike or incomplete; infraorbital foramina very large; palatal foramina very large and filling almost entire space between first molars and incisors, broadest medially; conspicuous peglike process on maxillary roots of zygomata just external to molar series; incisors of piercing type but not highly specialized as in *Ichthyomys*; upper molars not differing appreciably from those of *Ichthyomys*; coronoid process long, slender, falciform; lower molars somewhat different in pattern from those of *Ichthyomys* and *Rheomys*, anterior cusp of first molar broader, last molar with only one functional cusp, the posterior cusp being vestigial.

MEASUREMENTS.—Taken from the dried skin; total length, 204 mm.; tail vertebrae, 111; hind foot, 25.

This most interesting specimen is one of a collection of mammals obtained from Mr. Ludovic Soderstrom, who commented especially upon it when he gave it to me, expressing the opinion that it was not *Ichthyomys soderstromi*. This was quite evident when the specimen was compared with a good series of *Ichthyomys*, fourteen specimens representing four species, and *Rheomys*, one specimen. That it should prove to be an unknown genus is rather surprising, but, since it cannot be definitely referred to one of the existing genera, I find it necessary to erect a fourth genus of the *Ichthyomys* group.

From any of the species of *Ichthyomys*, *Neusticomys monticolus* may be readily distinguished by its much smaller size and less advanced specialization for swimming. The feet and toes of this new form are only weakly fringed with hairs, while the foot of *Ichthyomys* is a most obvious swimming structure. From *Rheomys*, which genus has not been taken south of Panama, to my knowledge, *Neusticomys* can be told by its greatly reduced hallux and by its single cusped last lower molar. *Anatomys leander*, described from the Quito region by Thomas,¹ is much larger, lacks the external ear, which in *Neusticomys* is proportionally larger than in *Ichthyomys* and actually as large, has "muzzle set on in a peculiar manner," while the superior outline of the skull of *Neusticomys* is almost a straight line. A second specimen of *Anatomys* recorded by Lönnberg² who confirms the type description, proves that the peculiarities of the type specimen are not fortuitous or individual. Although I have not seen *Anatomys*, I feel *Neusticomys* can have so little in common with this genus, that I have not hesitated to describe it as a new.

Apparently, *Neusticomys* is the least specialized of the *Ichthyomys* group.

¹1906, Ann. and Mag. Nat. Hist., (7) XVII, p. 86, January.

²1921, Archiv. für Zool., XIV, No. 4, p. 37.

MEASUREMENTS OF SKULLS OF DIFFERENT MEMBERS OF THE *Ichthyomys* GROUP

	GREATEST LENGTH	LENGTH OF NASALS	ZYGOMATIC BREADTH	BREADTH OF BRAINCASE	BREADTH OF ROSTRUM, AT MAXILLARY SUTURES	INTERORBITAL BREADTH	PALATAL FORAMINA	ALVEOLAR LENGTH OF UPPER MOLAR SERIES	DIASTEMA	LENGTH, PALATE TO INCISORS	GREATEST LENGTH OF MANDIBLE	LENGTH OF MANDIBULAR MOLAR SERIES
<i>Neusticomys monticolus</i> 46574 type	26	9.4	12.4	12.5	4.4	4.8	4.7×2.3	4.3	6	10.8	15.8	4.4
<i>Rheomys raptor</i> ¹ 179026	25.2	10.3	13.2	12.2	4.3	4.8	4.6×1.9	4.2	6.2	11.3	16	4.1
<i>Anatomys leander</i> ²	27.5	9	14.8	13.8		3.9	4.9×2.3	4.6	6.7	11.2		
<i>Ichthyomys tweedii</i> 47798 type	35.3	12.5	18.8	15	7.5	4.3	6.4×2	5	9.3	16	25	4.5
<i>Ichthyomys sodestromi</i> 46730	31	11.5	15.5	14	6	4.8	5.8×1.9	4.5	8.3	14	21.5	4.5
46732	31.7	11.6	16.1	13.5	5.5	4.9	6 ×1.9	4.2	8.7	13.8	21.5	4.5
<i>Ichthyomys stolzmanni</i> 10109	32	9.3	15.7	13.9	6	4.7	6.1×2.3	3.9	8.3	14.4	21	4
<i>Ichthyomys hydrobates</i> 24354	32.8	10.5	15.5	14	6	4.4	6.6×2	4.5	8.5	15	22	4

¹Kindly loaned by U. S. N. M., Biol. Surv. Mammal Coll.

²Measurements taken from Thomas, loc. cit.

Blarina montivaga, new species

TYPE.—No. 47200, Amer. Mus. Nat. Hist., ♀ ad.; Bestion, Prov. del Azuay, Ecuador; altitude 10,000 ft; January 15, 1921; collector, H. E. Anthony. The type is a skin with skeleton, the teeth not showing any great amount of wear.

GENERAL CHARACTERS.—Resembling *equatoris* of Thomas,¹ but differing conspicuously in color.

DESCRIPTION.—

Color above, everywhere approximating a dark mouse-gray (Ridgway); below, mouse-gray; no area of demarcation along sides where color of upper parts merges into that of lower parts; tail agreeing in color with body.

Skull slightly larger than that of *equatoris*, with third unicuspid noticeably larger; dentition very lightly pigmented.

MEASUREMENTS.—Taken in the flesh: total length, 112 mm.; tail vertebrae, 31; hind foot, 15. Skull, greatest length, 22 mm. (20)²; mastoid breadth, 10.5 (9.7); length entire upper toothrow, 9.7 (8.7).

Montivaga may be easily distinguished from all other known *Blarina* from South America on the basis of color alone, being much grayer than the dark brown or blackish pelages, of *squamipes*, *meridensis*, *thomasi*, *equatoris*, or *osgoodi*.³ A series of five, all collected at the type locality, are very uniform in coloration.

The new species has a hairy foot, showing very little of the squamation which characterises *squamipes*, and, to a certain extent, *equatoris*. The teeth of *montivaga* are almost entirely white, displaying but slight pigmentation, a character which appears to be fairly conspicuous in *squamipes*, *thomasi*, *equatoris*, and *osgoodi*.

Anoura geoffroyi antricola, new subspecies

TYPE.—No. 47282, Amer. Mus. Nat. Hist., ♀ ad.; Loja, Ecuador; altitude 9000 ft.; October 30, 1920; collector, H. E. Anthony. The type is a skin with skull.

GENERAL CHARACTERS.—Similar to *geoffroyi geoffroyi* in size but noticeably darker in coloration, less brown.

DESCRIPTION.—Above, hairs clove-brown (Ridgway), lighter colored at the base, except on rump where hairs are almost unicolor, the lightest colored basal area being on the shoulders where the color is pale olive-buff; below, hair brown, darker at the base on abdominal region, unicolor on throat; membranes blackish.

MEASUREMENTS.—Taken in the flesh: total length, 81 mm.; hind foot, 13.5. Greatest length of skull, 26 (*geoffroyi*, 24.5; *apolinari*, 25.5); breadth of braincase, 10 (10; 9.5); least breadth of rostrum, 4 (4.5; 4); length of palate, to gnathion, 14.5 (13.5; 14); length of upper molar series, 8.5 (7.5; 8.25).

¹1912, Ann. Mag. Nat. Hist., (8) IX, p. 409.

²Measurements in parentheses are of No. 46683, *Blarina equatoris*, from the slopes of Pichincha.

³Dr. Witmer Stone, of the Academy of Natural Sciences of Philadelphia, has kindly loaned me specimens of *osgoodi*, which I rather suspect must stand as a synonym of *equatoris*, described in 1912 by Thomas, who had specimens from the same slopes whence came the type of *osgoodi*. More material is needed to settle this point.

A large series of this form were taken, both as skins and as specimens in alcohol, and twenty-four skins afford an excellent opportunity to note the extent of individual variation. The entire series agrees with the type in dark coloration and no one of them approaches specimens of typical *geoffroyi* from Trinidad and Merida. In coloration the Ecuador series more nearly resembles *Anoura geoffroyi apolinari* (Allen), which was described as a *Glossophaga*¹ but which upon an examination of the skull I find to be an *Anoura* subspecifically distinct from *geoffroyi*. However, they lack the warmer shade of brown seen in *apolinari*.

***Cænolestes caniventer*, new species**

TYPE.—No. 47174, Amer. Mus. Nat. Hist., ♂ ad.; El Chiral, Western Andes; altitude, 5350 ft.; Prov. del Oro, Ecuador; August 2, 1920; collector, H. E. Anthony. The type is a skin and skeleton.

GENERAL CHARACTERS.—Resembling *fuliginosus* but less brownish above and decidedly lighter colored below; larger in size.

DESCRIPTION.—

Color, above, fuscus black (Ridgway) in effect, the pelage made up of dark hairs and a sprinkling of buffy tipped hairs, the color of all the hairs plumbeous at the base; below, much lighter than above, the tips of the hairs varying from cream-color to soiled whitish with a darker pectoral area approaching in color the hairs of the upper parts; hands and feet light brown; tail but little lighter below than above, brown.

Skull essentially like that of *obscurus* or *fuliginosus* but apparently larger.

MEASUREMENTS.—Taken in the flesh; total length, 256; tail vertebrae, 127; hind foot, 26.5. Greatest length of skull, 33.5; length of nasals, 16; zygomatic breadth, 16.3; mastoid breadth, 11.5; length of upper toothrow, I-M⁴, 17.6

Through the kindness of Dr. Stone, I have before me the two specimens of *Cænolestes fuliginosus* collected by Rhoads on Mt. Pichincha, both females, the trunks of which are preserved in alcohol. I have had the skull of one of these carcasses cleaned for examination. I also have for comparison a skin, without skull, from Papallacta, Ecuador, donated by Mr. Soderstrom of Quito, which I have determined to be *fuliginosus*; and, finally, a specimen of *obscurus*, male, skin and skull, from the Plains of Bogotá. I have sufficient material to be certain that the southern Ecuador *Cænolestes* is a distinct species, the most obvious character of separation being that of color, but in addition the new species is apparently larger. Because there is considerable difference in size shown by the series of *caniventer*, coupled with the fact that the males are noticeably larger than the females, it is not safe at present to be positive that the apparent size difference is the true one.

However, *caniventer* differs more radically in color from either *obscurus* or *fuliginosus* than do the latter from one another.

¹1916, J. A. Allen, Bull. Amer. Mus. Nat. Hist., XXXV, p. 86.

59.57.99(78)

SOME PARASITIC MEGACHILID BEES OF THE WESTERN UNITED STATES

By T. D. A. COCKERELL

The fauna of the Western United States, especially that of the Rocky Mountain and Pacific Coast Regions, when fully known, will doubtless furnish many valuable clues to aid in solving the perplexing problems of geographic distribution in North America. As still further collecting is desirable before the final report of the American Museum's expeditions is published, the following notes on the parasitic megachilid bees thus far obtained are presented at this time. The specimens were collected by Dr. Frank E. Lutz, except where otherwise noted, and the field notes are by him.

Cœlixys Latreille

Cœlixys deplanata Cresson

UTAH: 1 ♀, Huntsville (a few miles east of Ogden), July 26, 1920; 3 ♀, near Fort Douglas, Salt Lake City, about 5000 ft. alt., July 28, 1920. COLORADO: 1 ♂, hair of face pure white, Palisades, near Grand Junction, about 4750 ft. alt., at *Melilotus alba*, July 18, 1919; 1 ♀, Wray, about 3700 ft. alt., August 17, 1919; 1 ♂, large, hair of face creamy white, lower apical spines of abdomen very stout; Regnier, south of Lamar, about 4400 ft. alt., June 8, 1919. All of these specimens were found in quite xerophytic situations.

Cœlixys novomexicana (Cockerell)

ARIZONA: 1 ♀, Lowell Ranger Station, about 2700 ft. alt., August 18, 1916; 2 ♂, Sabino Basin, about 3800 ft. alt., July 10, 1916; 1 ♂, Mud Springs, about 6500 ft. alt. All of these localities are in the Santa Catalina Mts. along the Sabino trail from Tucson to Mt. Lemon. Mud Springs is rather high in the oak-pinyon environment; the Sabino Basin presents a variety of conditions within a small area but chiefly xerophytic; the country at Lowell is desert—the lower part of the Upper Bajada (Shreve's nomenclature)—but the Sabino River and a water hole introduces more mesophytic vegetation.

The male is new. It runs in my table (1912, Canadian Ent., XLIV, p. 168) of males to *sayi*, from which it is known by the two spots of pubescence on the anterior part of the mesothorax and by the entirely red femora. The Sabino Basin specimens differ in having the first recurrent nervure received at the extreme base of second submarginal cell, almost meeting the transverse cubital. They are also a little smaller.

***Cælioxys octodentata* Say**

(= *altilis* Cresson)

UTAH: 1 ♀, Ogden, about 4350 ft. alt., August 30, 1916. COLORADO: 2 ♀, Wray, about 3700 ft. alt., along Dry Willow Creek, August 18, 1919. INDIANA: 1 ♀, Lafayette, August 16, 1920. Even the western specimens came from moderately mesophytic situations along streams.

***Cælioxys modesta* Smith**

INDIANA: 1 ♀, Lafayette, August 16, 1920. A variety with dark legs and nervures.

***Cælioxys apacheorum* Cockerell**

COLORADO: 1 ♀, between Boulder and Orodell along the rather mesophytic canyon bottom, about 5600 ft. alt., August 11, 1919.

Described from New Mexico.

***Cælioxys rufitarsis* Smith**

UTAH: 1 ♀, 3 rather small ♂, Ogden, about 4350 ft. alt., August 30, 1916; 1 ♂, Huntsville (a few miles east of Ogden), July 26, 1920; 1 ♀, Provo, about 4500 ft. alt., in an irrigated field, July 31, 1920. COLORADO: 1 ♀, Palisades, near Grand Junction, about 4750 ft. alt., July 18, 1919; 1 ♀, 1 ♂, Rifle, about 5400 ft. alt., July 19, 1919; 1 ♀, from a vacant lot in Pueblo, August 9, 1920.

***Cælioxys ribis* Cockerell**

WYOMING: 1 ♀, Jackson, about 6300 ft. alt., among aspens and various plants of a moderately moist pasture-land type, July 15, 1920. COLORADO: 1 ♂, Ouray, about 8500 ft. alt., among Douglas spruce, aspen, scrub-oak, etc., July 11, 1919; 1 ♀, August 7, 1920, and 1 ♂, August 1, 1919, Tennessee Pass, about 10,400 ft. alt., in the lodge-pole pine area; 1 ♀, 1 ♂, Leadville, about 10,200 ft. alt., collected in the town by Mr. H. F. Schwarz.

***Cælioxys porterae* Cockerell**

COLORADO: 1 ♀, between Aspen and Highland along Castle Creek, about 8500 ft. alt., oaks, aspens and a few spruce, collected by Mr. H. F. Schwarz, July 25, 1919; 1 ♀, Glenwood Springs, about 5800 ft. alt., oak, squaw-bush, sunflower, etc., collected by Mrs. F. E. Lutz, August 5, 1920, 1 ♀, Boulder, about 5500 ft. alt., in town, August 8, 1919.

This was described as a possible variety of *lucrosa* Cresson but the transverse channel on the second abdominal segment is deep and entire, whereas, according to Sladen, it is widely interrupted in *lucrosa*. The type locality of *lucrosa* is New York State.

***Cælioxys texana* Cresson**

INDIANA: 1 ♂, Lafayette, August 16, 1920.

***Cœlixys edita* Cresson**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

Crawford has suggested that this is a synonym of *deplanata*. I am able to recognize some differences, and for the present must regard *edita* as valid.

***Cœlixys sayi* Robertson**

INDIANA: 1 ♂, Lafayette, August 16, 1920.

The form from Virginia which I had regarded as *sayi* has longer axillar spines, the abdomen with larger and sparser punctures, and the last dorsal segment more produced. It is certainly distinct. Robertson's name *sayi* must be considered as based on Say's *octodentata* variety α . "Spots and lines of the thorax [i. e., of white pubescence] obsolete; feet, excepting the tarsi, black." The Virginia insect has the spots and lines present, but the clypeus is bilobed. The last dorsal segment is more produced than in *octodentata*. The femora are black with red knees, tibiæ red stained with black, tarsi reddish basally, apically black, the hind pair black from end of basitarsi on. This may accordingly be separated as:

***Cœlixys mendacina*, new species**

TYPE: ♀. Falls Church, Virginia, June 2, (N. Banks). Length a little over 9 mm. The male (length, 8.2-9 mm.) is indicated in the table below.

It is quite likely that Say mixed more than one species, even under his variety α ; but Cresson's description of *octodentata* (1864) which Robertson cites under *sayi*, disagrees in saying that the legs are ferruginous, "the coxæ and sometimes the femora and tibiæ more or less blackish." The Lafayette *sayi* agrees with Crawford's statement that the clypeus is bilobed as viewed from above, not truly emarginate. It seems reasonable to take the Indiana form as true *sayi*, but the whole matter is perplexing. The male of *sayi*, according to Robertson, has the legs black, the tibiæ and tarsi more or less tinged with red.

***Cœlixys fragariæ* Cockerell**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., along the river bank, July 21, 1919.

I give a new description from the Colorado specimen, as the original account was rather brief.

♂.—Length, about 11 mm., slender; black, including tarsi, mandibles and antennæ, but tegulæ red; face densely covered with pure white hair, but on cheeks it is thinner, not wholly hiding surface, but with no smooth space; eyes grayish, with moderately long hair; third antennal joint shorter than fourth; mesothorax and

scutellum densely and very closely punctured, the mesothorax with a median longitudinal depression; anterior margin of mesothorax with a pair of conspicuous white hair-spots; bands of white hair behind mesothorax and scutellum; scutellum with very large punctures, no apical projection; axillary teeth long and somewhat curved; wings dusky hyaline, broadly infuscated apically; stigma ferruginous, nervures fuscous; basal nervure falling a little short of transverse median; recurrent nervures joining second submarginal near apex and base; spurs red; abdomen shining, with strong sparse punctures; first segment with basal and apical white bands, band on basal segment interrupted in middle, the others with successively weaker white bands, but strong bands of white hair in the transverse sulci, broadly interrupted on second, successively less interrupted on the following segments, and nearly entire on the fifth; sides of second segment behind sulci with large opaque areas but no foveæ; fifth segment without distinct lateral spines, sixth with slender lateral spines and six apical ones, the upper apical being each divided into two sharp spines; fourth ventral segment with two sharp spines on margin.

By the two spines on the fourth ventral this falls next to *C. erysimi* Cockerell, which is very closely related. *C. erysimi* has black tegulæ. *C. quercina* Cockerell is of the same group, but the legs are largely bright ferruginous. For other distinctions see Canadian Entomologist, June 1912.

***Cœlioxya aperta* Cresson**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

C. aperta was based on a single female collected by Morrison in Colorado. The male before me may I think be safely referred to the same species.

♂.—Length 10 mm.; black, including antennæ, mandibles and tarsi, the tegulæ very obscurely reddish in middle; face, front and cheeks densely covered with long pure white hair; cheeks beneath with a small inconspicuous bare area; third antennal joint longer than fourth; eyes pale green, with moderately long hair; mesothorax and scutellum coarsely and densely punctured, scutellum with a median projection; axillary spines very long, sharp, wings brownish, stigma and nervures dark; basal nervure meeting transverse median; first recurrent nervure joining second submarginal cell nearer base than second to apex; anterior coxæ spined; abdomen with very broad pure white hair-bands on segments 1 to 5; no white hair at bases of segments or in sulci; second segment strongly punctured, without foveæ; sides of fifth with short spines; sixth segment short, with long curved lateral spines and four short apical ones, the upper very broad; venter with broad, dense, white hair-bands.

On account of the median projection on scutellum, this falls next to *C. germana* Cresson and *C. totonaca* Cresson. For the distinctions see Psyche, October 1905, p. 89.

***Cœlioxya lucrosa* Cresson**

COLORADO: 2 ♂, Telluride, along the trail near Cornet Creek at about 10,000 ft. alt., chiefly aspen following cut-over spruce; July 9, 1919; 1 ♂, Boulder, about 5500 ft. alt., at *Grindelia* in town, August 8, 1919.

Cresson described *C. lucrosa* from the female, collected by Comstock in New York State, and by Morrison in Colorado. I have never found the female in Colorado. Sladen (Canadian Entom., June 1915) gave characters for both sexes. The males recorded above agree with his account of male *lucrosa*, and are referred there. I give a description from a Telluride specimen.

♂.—Length about 9 mm.; black, including tarsi, mandibles, antennae and tegulae; face with long white hair, faintly tinged with creamy; cheeks with thin hair, and a large smooth space below; third antennal joint longer than fourth; eyes gray, with moderately long hair; mesothorax and scutellum strongly punctured, but disc of mesothorax shining between punctures; scutellum simple; axillary teeth short, triangular, wings hyaline, broadly dusky apically; stigma ferruginous, nervures fuscous; basal nervure falling short of transverse median, second submarginal cell receiving recurrent nervures about equally distant from base and apex respectively; spurs red; abdomen shining, sparsely punctured, with pure white hair-bands on apices of segments 1 to 4, broad at sides but very thin in middle; sulci without hair, interrupted in middle; foveae on second segment large and elongate; fifth segment with short stout lateral spines; sixth with long sharp ones; apex of sixth with four spines, the lower ones long and slender; margin of fourth ventral segment in middle smooth and reddish.

***Cœlixys lutzii*,¹ new species**

UTAH: 1 ♀ (the type), Ogden, about 4400 ft. alt., in the Ogden canyon near "Pine View," mesophytic situation along the stream, August 29, 1916. WYOMING: 1 ♂, Jackson, about 6300 ft. alt., aspens and various plants of a moderately moist pasture-land type, July 15, 1920. COLORADO: 1 ♂, at about 37° 27' N., 106° 54' W. in Mineral county near Wolfand Fall Creeks along the road across the continental divide, oak, Engelman spruce, etc., June 20, 1919.

♀.—Length, 10.5 mm.; black, including tarsi, tegulae, antennae and mandibles; head and thorax with dull white hair, abundant on thorax behind; clypeus normal, minutely and densely punctured, with some large punctures interspersed; eyes gray, with short hair; third antennal joint nearly as long as fourth; mesothorax and scutellum very densely and coarsely punctured; scutellum simple; axillary spines short, thornlike, curved; wings dusky hyaline, stigma and nervures dark; first recurrent nervure joining second submarginal farther from base than second from apex; basal nervure meeting transverse median; second submarginal cell very broad on marginal cell; spurs black; abdomen shining, sparsely punctured; white hair-bands on apices of segments 1 to 4, broadly interrupted on first; no white hair in sulci; sulcus on second segment entire, the region behind it in middle very sparsely punctured; last dorsal sharply pointed, keeled its whole length, not abruptly narrowed at sides; last ventral considerably longer than last dorsal, narrow, minutely notched on each side before apex; third ventral segment strongly punctured, but with a median oval smooth space in which is a small tubercle; last ventral closely punctured.

¹Named after Dr. Frank E. Lutz, the leader of the Rocky Mountain Expeditions, which will enormously increase our knowledge of western entomology when the rich materials have been sorted and recorded.

♂.—Length about 9 mm.; face with long white hair; third antennal joint quite as long as fourth; large irregular punctures in middle of mesothorax, with a little shining surface showing between; cheeks with a smooth space below; anterior coxæ spined; abdomen shining, sparsely punctured, with entire pure white bands on apical margins of segments and white hair at base of fifth and sixth, second segment with small foveæ; sides of fifth with very short spines, of sixth with long ones; apex of sixth quadridentate, all the teeth rather slender, the upper ones divergent, the lower forming a U; fifth ventral segment depressed and shining in middle.

The female runs to *C. mæsta* Cresson in Crawford's table, but it differs in the color of the tegulæ and the shining area on under side of abdomen. The male is known from *mæsta* by the character of the foveæ on second abdominal segment.

***Cœlioxys mesæ*, new species**

COLORADO: 1 ♂, on the Chapin mesa at about 37° 12' N., 108° 29' W. in the Mesa Verde National Park, pinyon, Sabina, sagebrush, etc., at the flowers of *Pentstemon coloradensis*, July 5, 1919.

♂.—Length about 10 mm., robust; black, including legs, mandibles and antennæ; tegulæ dark reddish, head broad, face with long white hair, cheeks little hairy, densely and coarsely punctured, with a smooth space on extreme lower part; third antennal joint slightly longer than fourth; eyes pale green, with moderately long hair; mesothorax and scutellum densely, coarsely punctured; margin of scutellum simple; axillary spines rather long; wings brownish hyaline, stigma clear ferruginous, nervures fuscous; basal nervure meeting transverse median; second submarginal cell receiving first recurrent nervure nearer base than second recurrent nervure from apex; anterior coxæ with very stout spines; spurs dark red; abdomen closely punctured, the second and third segments dull and densely punctured, with strong entire transverse sulci, which are not hairy; hind margins of segments 1 to 4 with white hair-bands, and white hair also at bases of 4 and 5; first segment also with a broad basal hair-band, so that not much of its upper surface is exposed; fifth segment with short stout lateral teeth, sixth with long but obtuse ones; apex of sixth with four teeth, the upper two more divergent than the lower; lower rather short; venter closely punctured, segments 2 to 4 with broad white hair-bands.

Especially known by the sculpture of the abdomen.

***Cœlioxys lamellicauda*, new species**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., collected in the school grounds by Mr. Pearce Bailly, Jr., July 21, 1919.

♂.—Length about 9 mm.; black, including mandibles, tarsi, antennæ and tegulæ; face and cheeks with dense pure white hair, cheeks with groove below; third antennal joint longer than fourth; eyes gray, with short hair; mesothorax and scutellum densely punctured; scutellum simple; axillary spines long; wings hyaline, dusky apically, stigma dark reddish, nervures fuscous; basal nervure meeting transverse median, second submarginal cell receiving first recurrent nervure nearer base than second recurrent nervure from apex; anterior coxæ with very stout spines; spurs red; hind margins of abdominal segments with broad entire hair-bands; first

segment also with a basal band; no hair in the sulci, which are entire on segments 2 and 3; segment 2 with small shining spaces but no foveæ; sides of fifth segment with very short teeth, of sixth with long ones; apex of sixth with four teeth, the upper ones very broad and obtuse, strongly divergent; venter with entire white hair-bands.

Especially known by the shining areas (but no foveæ) on second abdominal segment, and lamelliform upper apical teeth.

The above *Calioxys* may be separated by the following key.

1. Females.....2.
Males.....12.
2. Legs red; eyes with short hair3.
Legs mainly or wholly black, or only tarsi red5.
3. Last ventral segment very broad; margin of clypeus entire... *deplanata* Cresson.
Last ventral segment rather narrow4.
4. Over 12 mm. long; clypeus deeply notched or bilobed... *novomexicana* Cockerell.
Under 10 mm. long; clypeus ordinary..... *octodentata* Say.
5. Last ventral broad, entire, without lateral notches.....6.
Last ventral notched at sides7.
6. Axillary spines short; last ventral very broad, with an apical point.
modesta Smith.
Axillary spines long; last ventral without a salient apical point.
apacheorum Cockerell.
7. Last dorsal with salient lateral angles, or abruptly notched... *rufitarsis* Smith.
Last dorsal without such angles.....8.
8. Last ventral broad, with strongly convex margins before the long apical projection (see figure in Canadian Entom., July 1915, p. 205); hair on eyes long..... *ribis* Cockerell.
Last ventral without strongly convex sides.....9.
9. Conspicuous white hair-markings on thorax above; clypeus bilobed or broadly emarginate, with dense pure white hair filling space between clypeus and mandibles; angle formed by emargination of clypeus less acute than in *novomexicana*..... *mendacina* Cockerell.
No conspicuous white hair-markings on thorax above.....10.
10. Last ventral very narrow; third ventral with a median polished oval impunctate space..... *lutzi* Cockerell.
Last ventral not so narrow; third ventral without a specialized area.....11.
11. Tegulae clear bright ferruginous; hair of eyes very short..... *sayi* Robertson.
Tegulae dark rufopiceous; hair of eyes much longer..... *porteræ* Cockerell.
12. Legs at least mainly red.....13.
Legs red, coxæ and under side of femora black; second abdominal segment with small foveæ; hair of eyes short; hair of face pure shining white; cheeks with a large bevelled hairless space; apex of sixth abdominal segment quadridentate, the upper teeth strongly diverging... *mendacina* Cockerell.
Legs mainly or wholly black.....16.
13. Mesothorax with large well-separated punctures on disc; tegulae bright ferruginous; end of abdomen multidentate..... *texana* Cresson.

- Mesothorax very densely punctured; conspicuous light hair in scutello-mesothoracic suture.....14.
14. Second abdominal segment with a pair of small oval foveæ on a smooth surface.
novomexicana Cockerell.
- Second abdominal segment without such foveæ.....15.
15. Larger; abdomen more coarsely and less densely punctured; first recurrent nervure joining second submarginal cell as far from base as second from apex.....*deplanata* Cresson.
- Smaller; abdomen more finely and closely punctured; first recurrent nervure joining second submarginal cell very near base, or even meeting first transverse cubital.....*edita* Cresson.
16. Scutellum with a median apical tubercle; lower apical teeth of abdomen divergent; tegulæ almost pure black; hair of eyes long....*aperta* Cresson.
- Scutellum without a median tubercle.....17.
17. Conspicuous light hair in scutello-mesothoracic suture; apex of sixth abdominal segment with six teeth; fourth ventral with two sharp spines on margin.
fragariæ Cockerell.
- No conspicuous sutural hair or spots on thorax above; tegulæ black or dark reddish.....18.
18. Tarsi red.....*rufitarsis* Smith.
- Tarsi black, lower apical teeth of sixth segment parallel or almost.....19.
19. Stigma ferruginous; first recurrent nervure going only a little beyond first transverse cubital; second abdominal segment dull and very densely punctured.....*mesæ* Cockerell.
- First recurrent nervure going considerably beyond first transverse cubital; stigma often piceous.....20.
20. Rather large and robust; second abdominal segment behind the sulcus very densely and finely punctured, without foveæ; hair of eyes very long.
ribis Cockerell.
- Smaller or more slender; second abdominal segment otherwise.....21.
21. Second abdominal segment with large transverse foveæ; axillary spines very short; apex of fourth ventral abdominal segment produced, smooth, bare and red; transverse sulcus on second abdominal segment interrupted; second submarginal cell on marginal hardly or not longer than first transverse cubital.....*lucrosa* Cresson.
- Second abdominal segment with foveæ minute or absent.....22.
22. Axillary spines long; second segment with a pair of shining spaces but no foveæ.....*lamellicauda* Cockerell.
- Axillary spines very short; second segment with small clongate-punctiform foveæ; second submarginal cell on marginal considerably longer than first transverse cubital; transverse sulcus on second abdominal segment entire.
luzti Cockerell.

The host-relationships of the American *Cælioxyx*s are little known. Grænicier found *C. rufitarsis* Smith parasitic on *Megachile melanophæa* Smith and *M. latimanus* Say. He found *C. lucrosa* Cresson or a closely related species parasitic on *M. addenda* Cresson. In Europe there are records of *Cælioxyx*s parasitic on *Anthophora*, but they need confirmation.

According to the statements of Alfken (Die Bienenfauna von Bremen), the species of *Cælioxyys* do in some cases live on more than one species of *Megachile*, but they are by no means indiscriminate. Thus we have:

Parasite	Host
<i>C. aurolimbatus</i> Först	<i>Megachile ericetorum</i> Lepeletier
<i>C. trigonus</i> Schrank	<i>M. maritima</i> Kirby
<i>C. quadridentatus</i> Linnæus	<i>M. circumcincta</i> Kirby and <i>M. willughbiella</i> Kirby
<i>C. acuminatus</i> Nylander	<i>M. centuncularis</i> Linnæus (probably)
<i>C. mandibularis</i> Nylander	<i>M. argentata</i> Fabricius
<i>C. rufocaudatus</i> Smith	<i>M. rotundata</i> Fabricius

Bingham, in India, observed that *C. basalis* Smith lived in nests of *M. lanata* Fabricius. As *Cælioxyys* is world-wide, one might expect to find the number of species roughly proportioned to that of *Megachile*. In Australia, however, the forms of *Megachile* are excessively numerous and varied, but there are only four *Cælioxyys* (*albiceps* Friese, *reginæ* Cockerell, *albolineata* Cockerell, *froggatti* Cockerell). It seems probable that the genus originated in the Western Hemisphere; it is especially abundant in the Neotropical Region, with 110 species described up to the present time.

In the Nearctic Region, the species seem to be usually restricted, or nearly restricted, to a single province, as we find with other bees. *C. lucrosa* Cresson and *sodalis* Cresson are reported from New York to Colorado; *C. rufitarsis* Smith is similarly widely distributed in the Northern part of the continent and the western mountains. *C. octodentata* Say, *mæsta* Cresson and *porteræ* Cockerell also extend from the Atlantic coast region to the Rocky Mountains. Presumably these all infest the wide-spread species of *Megachile*, whereas the more local ones parasitise the local species of the host-genus. *C. fragariæ* Cockerell was described from an altitude of 6000 ft. on the San Jacinto Mountains of California; it now turns up at about the same altitude in Western Colorado.

The Nearctic *Cælioxyys* at the present time number 52 species and six races or varieties. Of these, nine (*edita* Cresson, *insita* Cresson, *scitula* Cresson, *texana* Cresson, *hunteri* Crawford, *piercei* Crawford, *arenicola* Crawford, *asteris* Crawford, *pratti* Crawford), were described from Texas, whence *edita* and *texana* extend northward. A race of *texana* (*sonorensis* Cockerell) occurs at San José de Guaymas, Mexico. Ten (*mentha* Cockerell, *gilensis* Cockerell, *porteræ* Cockerell, *apacheorum* Cockerell, *grindeliæ* Cockerell, *ribis* Cockerell, *soledadensis* Cockerell, *texana vegana* Cockerell, *rufitarsis rhois* Cockerell, *novomexicana* Cockerell) were

described from New Mexico. Of these *porteræ* extends to Virginia, and *ribis* has been taken by Grænicier in Wisconsin and by Sladen in Ontario. *C. apacheorum* is now recorded from Colorado.

Six (*coquilletti* Crawford, *angelica* Cockerell, *fragariæ* Cockerell, *hirsutissima* Cockerell, *megatricha* Cockerell, *angulifera* Cockerell) have been described from California. Of these, *fragariæ* extends eastward to Colorado. Four (*floridana* Cresson, *slossoni* Viereck, *obtusiventris* Crawford, *dolichos* Fox), have been described from Florida. *C. quercina* Cockerell is from Arizona; *C. ribis kincaidi* Cockerell is from Washington State; *C. aperta* Cresson, *coloradensis* Cresson, *erysimi* Cockerell, *deani* Cockerell, *grindeliæ denverensis* Cockerell and *crassula* Cockerell are from Colorado. *C. deplanata* Cresson occurs from Kansas to Utah and Washington State.

The remaining species are from the eastern and northeastern States, viz. *rufitarsis* Smith, *funeraria* Smith (Can.) *modesta* Smith, *octodentata* Say *alternata* Say, *sayi* Robertson, *rufitarsis melanopoda* Viereck, *germana* Cresson, *lateralis* Cresson, *lucrosa* Cresson, *mæsta* Cresson, *sodalis* Cresson (also Colo.), *comstockii*, Cresson (N. Y.), *immaculata* Cockerell (Ind.), *sculptifrons* Crawford (N. Y.), *banksi* Crawford (Va.), Robertson found seven species in Illinois (*sayi*, *modesta*, *germana*, *alternata*, *texana*, *rufitarsis*, *octodentata*).

There are in addition one new species from Virginia, one from Utah, Colorado and Wyoming, and two from Colorado, described above. It will be seen from the above that most of the records come from a few States, and there are many parts of the country from which the *Calioxys* are unknown.

CHELYNIA Provancher

Chelynia elegans (Cresson)

COLORADO: 5 ♀, Ward, about 9300 ft. alt., near town, August 8, 1919.

Chelynia monticola (Cresson)

IDAHO: 1 ♀, Bear Lake, along Fish Haven Creek at about 6200 ft. alt., July 9, 1920; 1 ♀, Giveout near Montpelier, about 6700 ft. alt., July 7, 1920; WYOMING: 3 ♀, Jackson, along Cache Creek from 6300 to 7000 ft. alt., July 15, 1920.

Chelynia subemarginata (Cresson)

IDAHO: 1 ♀, Bear Lake, along Fish Haven Creek at about 6200 ft. alt., July 9, 1920, collected by Mrs. F. E. Lutz. WYOMING: 1 ♀, 1 ♂, Jackson, along Cache Creek, at about 6300 ft. alt., July 15, 1920; collected by Mrs. F. E. Lutz. COLORADO: 1 ♂, Telluride, along the trail near Cornet Creek at about 11,000 ft. alt., July 9, 1919; 1 ♂, South Fork, about 37° 40' N., 106° 38' W. and 8200 ft. alt., June 17, 1919;

2 ♀, 2 very small ♂, Camp Creek Ranger Station at about 41° N., 106° 12' W., and 8700 ft. alt., July 19, 1921. All of these places are quite mesophytic, the Idaho one being the nearest approach to desert conditions. The specimens from Telluride and Camp Creek were taken not far from still-remaining snow.

The males are very variable in size but appear to represent a single species.

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NEW SPECIES OF NORTH AMERICAN LIZARDS OF THE GENERA *HOLBROOKIA* AND *UTA*

BY KARL PATTERSON SCHMIDT

In the course of an examination of the lizards belonging to the genera *Holbrookia* Girard and *Uta* Baird and Girard, I have found it necessary to recognize a number of new forms. In view of the necessary postponement of the publication of more complete reviews of these genera, I have characterized the new forms in the present preliminary paper and have included keys to the two genera which present in abstract the taxonomic conclusions to be discussed more fully in subsequent papers.

I am much indebted to the authorities of the United States National Museum, and especially to Dr. Leonhard Stejneger, Head Curator, Department of Biology, for the loan of valuable collections of *Holbrookias* and *Utas* from Mexico and the southwestern United States for study in connection with the collections of The American Museum of Natural History.

***Holbrookia pulchra*, new species**

DIAGNOSTIC CHARACTERS.—A slender, medium-sized species, allied to *H. elegans*, with tail considerably longer than the body, the hind leg averaging about four-fifths of the body length; dorsal scales flat; ventral scales large, 59 to 70 from collar to anus; femoral pores few, average 11.6; dorsal spots usually sharply defined, the dorsal and lateral series often confluent, enlarged supraoculars and frontals separated by scales not much smaller than either.

MEASUREMENTS OF TYPE.—Length, 120 mm.; body, 56 mm.; tail, 64 mm.; tail/total length, .53; foreleg, 28 mm.; hind leg, 47 mm.

RANGE.—Huachuca Mountains of southern Arizona, east of Nogales.

TYPE.—A. M. N. H. No. 14777; Carr Canyon, 5200 ft.; Huachuca Mountains, Arizona; May 14, 1919; R. D. Camp.

***Holbrookia maculata campi*,¹ new subspecies**

DIAGNOSTIC CHARACTERS.—Characters of *Holbrookia maculata*. Distinguished from *H. m. maculata* by coloration, which resembles that of *approximans*, and by the fewer, wider and more oblique upper labials, also as in *approximans*; distinguished from *m. flavilenta* by the same characters; distinguished from *m. approximans* by the longer tail and hind leg, especially of the female; tail/total length varies from .46 to .50 in ♀ *m. campi*, averaging .48, .42 to .48 in ♀ *m. approximans*, averaging .44; length of leg/body length ranges from .77 to .88 in ♀ *m. campi*, averaging .83, .65 to .78 in ♀ *m. approximans*, averaging .71.

¹Named for Mr. Charles Lewis Camp, the collector of the type series, and well known for his contributions to North American herpetology.

MEASUREMENTS OF TYPE.—Total length, 101 mm.; body, 53 mm.; tail, 48 mm.; tail/total length, 48; arm, 25 mm.; leg, 42 mm.

RANGE.—Probably the southern part of the Colorado Plateau in northern Arizona. Apparently not reaching Utah on the north, possibly entering New Mexico to the east. It is expected that it will be found to intergrade with *m. approximans* in central Arizona.

TYPE.—A. M. N. H. No. 7990; ♂, about 8 miles N. W. of Adamana, Apache County, Arizona; June 21, 1921; Charles L. Camp.

Holbrookia dickersonæ,¹ new species

DIAGNOSTIC CHARACTERS.—A large, stout bodied species, with a slightly flattened tail equal to or slightly shorter than the body; snout very obtuse; dorsal scales small, slightly convex; small granular scales between the enlarged supraoculars and the frontals; labials very short and at a high angle with the horizontal, strongly keeled, strongly projecting; femoral pores 9–13; coloration of *H. m. approximans*, but with three lateroventral black spots entirely surrounded by a patch of blue, which is equally distant from axilla and groin and covers more than half the distance between.

MEASUREMENTS OF THE TYPE.—Length, 116 mm.; body, 58 mm.; tail, 58 mm.; tail/length, .50; foreleg, 30 mm.; hind leg, 46 mm.

RANGE.—Known only from Castanuelas and Alamos de Parras in the state of Coahuila, Mexico.

TYPE.—U. S. N. M. No. 2668 A²; Castanuelas, Coahuila, Mexico; Lieutenant B. Couch, U. S. A.

KEY TO THE SPECIES OF *Holbrookia*

1. Tail flat with broad black ventral bands; lateroventral black marks placed far back, continued dorsally above the lateral fold (Central Texas to south and central Arizona.) *texana*.
Tail rounded; no black bands beneath tail (small black spots in one species); lateroventral marks more anterior, not present dorsally 2.
2. Tail longer than the body in both sexes 3.
Tail shorter than the body in the female, usually also in the male 5.
3. Dorsal scales very small, convex or keeled; a distinct area of supraocular granules between the enlarged supraoculars and the frontals; tail very long; dorsal spots usually indistinct. (Southern Texas.) *propinqua*.
Dorsal scales larger, flat; no distinct small supraoculars between the frontals and the central supraoculars; dorsal spots usually (not invariably) distinct, sharply outlined. 4.
4. Size large, habitus robust, body frequently exceeding 60 mm.; femoral pores usually 12 or more. (Lower altitudes, Tucson, Arizona south along west coast of Mexico through Sinaloa.) *elegans*.
Size smaller, habitus slender, body less than 60 mm.; femoral pores usually less than 12. (High altitudes, above 5000 ft., Huachuca Mts., to Nogales and Bisbee, Arizona.) *pulchra*.

¹Named for Miss Mary C. Dickerson, former curator of the Department of Herpetology, American Museum of Natural History.

²U. S. N. M. No. 2668 covering four male specimens, I designate the type by means of a lettered tag A.

5. Subcaudal black spots usually present; scales flat, not tubercular in large specimens; dorsal spots very sharply defined, often digitate behind. (Coahuila, Mexico, southern and central Texas, possibly to Kansas.)

lacerata.

Dorsal spots rarely sharply defined; no subcaudal black spots; scales keeled or tubercular in large specimens 6.

6. Three lateroventral black spots entirely surrounded by a blue patch. (Southern Coahuila, Mexico.) *dickersonæ*.

Two or three lateroventral black spots, often margined with blue, but no extensive blue patch *maculata*—7.

7. Snout somewhat pointed, labials narrow, elongate; usually three or four scales between the enlarged nasals; a mid-dorsal light stripe usually and two dorsolateral and two lateral light stripes frequently present. (Wyoming and Nebraska, south to Texas.) *maculata maculata*.

Snout more truncate, labials shorter, wider and more oblique to the horizontal; usually two or three scales between the enlarged nasals; no mid-dorsal light stripe 8.

8. Usual dorsal pattern indistinct, replaced by small irregular light and dark spots; ground color very pale. ("White Sands" of southern New Mexico.)

m. flavilenta.

Large dark dorsal spots present, ground color darker 9.

9. Tail shorter, .42-.50 of total in male, .42-.48 in female, hind leg shorter, .72-.83 in male, .65-.78 in female. (Northern Mexico, southern Arizona; ? southern Mexico.) *m. approximans*.

Tail longer, .48-.51 in male, .46-.50 in female; hind leg longer, .79-.86 in male, .77-.88 in female. (Central and northern Arizona, probably the Colorado Plateau.) *m. campi*.

***Uta wrighti*,¹ new species**

DIAGNOSTIC CHARACTERS.—Closely allied to *Uta ornata* and *Uta lewis*; distinguished from the former by the small and smooth lateral basal caudal scales, about 32 in the fifth verticil behind the enlarged postnals; from the latter by the well developed dorsolateral line of tubercles, and the more strongly keeled dorsal scales.

MEASUREMENTS OF TYPE.—Total length, 125 mm.; snout to anus, 43 mm.; tail, 82 mm.; tail/total length, .66; foreleg, 19 mm.; hind leg, 29 mm.; length of head, 11.5 mm.; breadth of head, 8.5 mm.

RANGE.—Western Colorado and southeastern and southern Utah.

TYPE.—A. M. N. H. No. 18097; ♂; Grand Gulch, San Juan County, Utah; elevation between 4000 and 5000 ft.; November 9, 1920; B. T. B. Hyde.

***Uta gadovi*,² new species**

DIAGNOSTIC CHARACTERS.—Frontal entire, four to six rows of enlarged dorsal scales, abruptly larger than the granular scales with no granular scales on the vertebral

¹Named for Dr. A. H. Wright of Cornell University, to whom I owe my introduction to vertebrate zoology.

²Named for Dr. Hans Gadov, the collector, with especial reference to his important zoological explorations in southern Mexico.

line; dorsolateral line and lateral fold set with prominent tubercular scales, with a row of tubercles between them; caudal scales strongly keeled, not spinose, in nearly uniform verticils.

MEASUREMENTS OF TYPE.—Total length, 134 mm.; snout to anus, 53 mm.; tail, 81 mm.; tail/total length, .60; foreleg, 20 mm.; hind leg, 30 mm.; length of head (to anterior border of ear), 11.5 mm.; breadth of head, 9.5 mm.

RANGE.—Jalisco and Michoacan, Mexico.

TYPE.—A. M. N. H. No. 20355; Cofradia, Jalisco, Mexico; 1902-1904; Dr. Hans Gadow.

***Uta tuberculata*, new species**

DIAGNOSTIC CHARACTERS.—Allied to *Uta bicarinata*, with which it has hitherto been confounded; distinguished from *bicarinata* by: (1) the longer head and less sloping profile; (2) the much less sharply spinose ventrals; (3) smaller size, not reaching 50 mm. of body length; (4) more regular series of lateral tubercles; (5) larger preauricular spines.

MEASUREMENTS OF TYPE.—Total length, 105 mm.; snout to anus, 45 mm.; tail, 60 mm.; tail/total length, .57; foreleg, 19 mm.; hind leg, 27 mm.; length of head 12.0 mm.; breadth of head, 9.0 mm.

RANGE.—States of Colima and Jalisco, Mexico.

TYPE.—A. M. N. H. No. 13737; ♂; Colima, State of Colima, Mexico; March 28, 1919; Paul D. R. Ruthling.

***Uta nelsoni*,¹ new species**

DIAGNOSTIC CHARACTERS.—A large species, with a high and short head, long limbs, and a rather elongate body; allied to *Uta bicarinata* and *U. tuberculata*. Ventral scales not mucronate; sides not distinctly tuberculate, not at all bristling in appearance; caudal scales irregular in size, in irregular whorls of three verticils each; dorsal series of enlarged scales beginning on the nape, interrupted on the shoulders.

MEASUREMENTS OF TYPE.—Total length (tail reproduced), 128 mm.; snout to anus, 58 mm.; foreleg, 23 mm.; hind leg, 33 mm.; length of head, 13.5 mm.; breadth of head, 10.5 mm.

RANGE.—Known only from the type locality.

TYPE.—U. S. N. M. No. 46836; ♂; Cuicatlam, Oaxaca, Mexico; October 9, 1899; E. W. Nelson and A. E. Goldman.

KEY TO THE SPECIES OF *Uta*

1. Dorsal scales very small, perfectly smooth; enlarged supraoculars in more than one row.....2.
- Dorsal scales less than 40 in the length of the head, at least faintly keeled posteriorly; enlarged supraoculars in one row.....3.
2. Caudal scales small, smooth. (Southern Lower California.).....*thalassina*.
- Caudal scales large, keeled, spinose. (Northern Lower California.)....*mearnsi*.
3. Dorsal scales nearly uniform, graduated into the smaller laterals.....4.
- Dorsal scales with a few median rows abruptly enlarged.....14.

¹Named for Dr. Edward W. Nelson, Chief of the Bureau of Biological Survey, U. S. Dept. of Agriculture, with especial reference to his contributions to the scientific exploration of Mexico.

4. Frontal entire.....5.
Frontal transversely divided.....6.
5. Dorsal scales very small, about 35 in head length. (Northern Lower California.)
microscutata.
Dorsal scales larger, a broad band of enlarged scales down the back (see also 23).
(Southern Lower California.).....*nigricauda*.
6. Gular scales about 40; femoral pores 17. (San Pedro Martir Island, Gulf of California.).....*palmeri*.
Gular scales less than 35; femoral pores less than 17.....7.
7. Hind leg short, .71 to .72 of the body length; dorsal scales very weakly keeled..8.
Hind legs more than .72 of the body length; dorsal scales more sharply keeled. 9.
8. Femoral pores average 13; dorsal scales average 103 from occiput to rump.
(Utah and Nevada.).....*stansburiana stansburiana*.
Femoral pores average 15; dorsal scales average about 115. (San Benito Islands, off Pacific Coast of Lower California.).....*stellata*.
9. Dorsal scales largest in the group, 70-78 from occiput to rump; hind leg .79 of the body length; femoral pores average 15. (Santa Catalina Island, Gulf of California.).....*squamata*.
Dorsal scales average more than 80.....10.
10. Hind leg averages .80 of the body length. (Southern Lower California.) *elegans*.
Hind leg averages .74 to .75 of the body length.....11.
11. Dorsal scales average about 86. (Southeastern California to western Texas and adjacent areas in Mexico. Angel de la Guardia Island.)
stansburiana stejnegeri.
Dorsal scales average more than 90.....12.
12. Size large, snout to anus 62 mm. (San Martin Island, off Pacific Coast of Lower California.).....*martinensis*.
Smaller, usually not exceeding 50 mm. in body length.....13.
13. Dorsal scales strongly keeled, average about 100; posterior femorals strongly keeled. (Southwestern California, San Joaquin Valley and Northwestern Lower California.....*stansburiana hesperis*.
Dorsal scales weakly keeled, average about 92; posterior femorals weakly keeled.
(Cedros and Natividad Islands off Pacific Coast of Lower California.)
concinna.
14. Frontal transversely divided.....15.
Frontal entire.....23.
15. Enlarged dorsal scales nearly uniform, with no series of small scales on vertebral line; tail long, about two-thirds of total. (Southern Nevada, southeastern California, and southwestern Arizona.).....*graciosa*.
One or more vertebral series of small scales.....16.
16. No tubercular scales forming a well defined dorsolateral line; enlarged dorsals nearly smooth.....17.
A well defined dorsolateral row of tubercles.....18.

17. A few enlarged scales on the dorsolateral line; upper posterior scales on thigh smooth. (Socorro Island, Revilla Gigedo Islands.).....*auriculata*.
 No enlarged scales on the dorsolateral line anteriorly; upper posterior femorals keeled. (Tierra Amarilla, New Mexico.).....*levis*.
18. Lateral scales at base of tail small, leaving four abruptly enlarged dorsal rows of caudals; 30-34 scales in the fifth verticil behind the enlarged postanals. (Southeastern Utah.).....*wrighti*.
 Lateral caudal scales larger, less than 30 in the fifth verticil.....19.
19. Enlarged dorsals beginning well forward on the nape.....20.
 Enlarged dorsals beginning on the shoulders.....*ornata*—21.
20. Enlarged dorsals anteriorly in one row on each side; dorsolateral tubercles small. (Tres Marias Islands; Sinaloa and Sonora, Mexico.)....*lateralis*.
 Enlarged dorsals anteriorly in two rows on each side; dorsolateral tubercles very large, close set. (Clarion Island, Revilla Gigedo Islands.)...*clarionensis*.
21. Enlarged dorsal scales more or less irregular in size and arrangement; no oblique series of tubercles between the dorsolateral line and the lateral fold. (Western Texas, New Mexico and Chihuahua, Mexico.).....*ornata ornata*.
 Enlarged dorsal scales in four very regular rows; oblique series of tubercles on the sides.....22.
22. Enlarged dorsals continuous with caudals; tubercular scales and basal caudals spinose; general appearance bristling. (Southeastern Arizona and adjacent area in Sonora, Mexico.).....*ornata linearis*.
 Tubercular scales and caudals less spinose; enlarged dorsals reduced on rump. (Southeastern California and southwestern Arizona.)...*ornata symmetrica*.
23. No dorsolateral line of tubercles. (Southern Lower California).....*nigricauda*.
 A well defined series of dorsolateral tubercles, at least posteriorly.....24.
24. No vertebral series of small scales separating the enlarged dorsals.....25.
 One or more vertebral series of small scales separating the enlarged dorsals..26.
25. Four to six regular series of enlarged dorsals. (Jalisco and Michoacan, Mexico).
gadovi.
 Two or three irregular series of very large dorsals. (Guerrero, Mexico.)
irregularis.
26. Ventral scales mucronate. (Oaxaca, Puebla, and Guerrero, Mexico.)...*bicarinata*.
 Ventral scales very faintly, if at all, mucronate.....27.
27. Enlarged dorsal scales beginning on the shoulders; lateral tubercles very distinct; scattered tubercles on neck. (Colima and Jalisco, Mexico.)...*tuberculata*.
 Series of enlarged dorsal scales beginning on the neck; lateral tubercles indistinct. (Cuicatlam, Oaxaca, Mexico.).....*nelsoni*.

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THE EPEOLINE BEES OF THE AMERICAN MUSEUM ROCKY MOUNTAIN EXPEDITIONS¹

By T. D. A. COCKERELL

This collection constitutes the most remarkable series of Epeoline bees which has ever reached my hands in a single consignment. The *Triepeolus* number 22 species, of which 16 are new; the *Epeolus* four species, with two species and a variety new. It appears that the Rocky Mountains constitute the greatest center for Epeolines in the world. In addition to the species now recorded, the following have been taken in Colorado:

- Epeolus bentahensis* Cockerell. (Type from New Mexico).
- “ *interruptus* Robertson. (Type from Illinois).
- “ *eldoradensis* Cockerell. (Type from Eldora, Colorado).
- “ *compactus* Cresson. (Type from Texas).
- Triepeolus helianthi grandior* Cockerell. (Type from Florissant, Colorado).
- “ *martini* Cockerell. (Type from New Mexico).
- “ *grindelia* Cockerell. (Type from Boulder, Colorado).
- “ *denverensis* Cockerell. (Type from Denver, Colorado).
- “ *rhoweri* (Cockerell). (Type from N. Boulder Creek, Colorado).
- “ *subalpinus* Cockerell. (Type from Eldora, Colorado).
- “ *gabrielis* Cockerell. (Type from California).

Colorado has in all 32 species of Epeolines. The whole Nearctic Region has 76; the Neotropical over 70. The Old World is not nearly so richly supplied. From Europe we know 15 species; from Palæarctic Africa, 7; from the Ethiopian region, 10. From Asia nine species are recorded; from the Australian region none. There are none in the Malay Islands; the Borneo record in Dalla Torre's Catalogue is an error. Two species occur in India (*E. peregrinus* Cockerell, *E. ferridus* Smith) and one (*E. assamensis* Meade-Waldo) in Assam. *E. ventralis* Meade-Waldo is found in China. In southern South America the genera *Isepeolus* Cockerell (9 species), *Doeringiella* Holmberg (6 species), and *Trophocleptria* Holmberg (2 species) represent a considerable diversification of the Epeoline fauna, but Bréthes considers that Holmberg's two genera should not be separated from *Epeolus*. Ducke in this matter follows Bréthes, but these authors take *Epeolus* in a broad sense, not separating

¹Unless otherwise stated, the bees reported upon in this paper were collected by Frank E. Lutz and the field notes are by him.

Triepeolus. *Leiopodus* Smith, with two Neotropical species, is related to *Isepeolus*. These two genera are not very near to *Epeolus*.

I consider *Triepeolus* a very good genus, apparently confined to the New World. It appears to live in the nests of Anthophoridæ, whereas *Epeolus* lives with *Colletes*. Gribodo (1894) described a subgenus *Diepeolus* for the Algerian *E. giannellii* Gribodo, having two free joints to the maxillary palpi instead of one. In general, the species resembles *E. fallax* Morawitz. *Argyroselenis* Robertson appears to be a synonym of *Diepeolus*, but the type species of the Algerian and American groups should be compared.

***Triepeolus concavus* (Cresson)**

COLORADO: 2 ♂, 4 ♀, Wray, about 3700 ft. alt., some at *Helianthus*, August 17-19, 1919; 4 ♂, 2 ♀, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♂, Pueblo, in vacant lots in the city, August 9, 1920.

This species is new to Colorado.

***Triepeolus concolor* (Robertson)**

COLORADO: 3 ♀, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz.

This is the first record from Colorado.

***Triepeolus lunatus* (Say)**

COLORADO: 1 ♀, Wray, about 3700 ft. alt., in the moist valley of Dry Willow Creek, August 18, 1919; 3 ♀, 1 ♂, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz.

Not previously recorded from Colorado.

***Triepeolus pectoralis* Robertson**

COLORADO: 2 ♂, 1 ♀, Wray, about 3700 ft. alt., in the moist places (1 male taken by evening sweeping along the river), August 19, 1919; 1 ♂, Pueblo, in vacant lots in the city, August 9, 1920; 1 ♂, Boulder, about 5300 ft. alt., on the plains between the town and Boulder Lake, August 12, 1919; 1 ♂ (mesothoracic stripes pointed in front, not reaching margin of mesothorax), Grand Junction, about 4500 ft. alt., along an irrigating ditch, August 3, 1920.

The first records from Colorado.

***Triepeolus pænepectoralis* Viereck**

COLORADO: 2 ♂ (labrum red; clypeus without a median line; longitudinal bands of mesothorax widely separated from lateral patches), Wray, about 3700 ft. alt., dry, sagebrush country, August 17, 1919; 1 ♂ (labrum red; clypeus with a median shining line; longitudinal bands of mesothorax broad and not far distant from the large patches), Fruita, not far from Grand Junction, about 4500 ft. alt., at *Helianthus* along the road, July 16, 1919.

Not hitherto reported from Colorado. *T. pænepectoralis* from Washington State, as I have recognized it, is variable, and I am not able to separate the Colorado specimens as a distinct species. It is, however, quite possible that more material would justify the segregation of one or even two species.

***Triepeolus fortis*, new species**

COLORADO: 1 ♀, Wray (type locality), about 3700 ft. alt., in the cottonwood area at the head of Dry Willow Creek, August 18, 1919; 2 ♂, La Junta, about 4100 ft. alt., at the edge of an irrigated field, August 12, 1920, collected by Mrs. F. E. Lutz.

♀ (Type). Length about 14 mm.; robust, black, with cream-colored markings; first three antennal joints (except on inner side), labrum and mandibles dark red; legs bright chestnut red; tegulae dark reddish marked with black, the general effect dark; axillae black. Head broad; eyes purplish, with upper third green; clypeus very densely and minutely punctured, with some scattered shallow large punctures, and a smooth median line; third antennal joint much shorter than fourth; mesothorax dull and granular, with an ochreous border (except in middle anteriorly) and a pair of dagger-shaped well-separated bands, their broad bases resting on the anterior border and continuous with the ochreous margin laterad; scutellum bigibbous, axillae stout and rather long; pleura densely granular and dull, mainly naked, but with pubescence behind the tubercles and a lobe extending backward at level of lower end of tubercles; area of metathorax with two shining spaces, separated by a dull T; wings strongly brownish, stigma and nervures dark brown; spurs black; hair on inner side of hind basitarsi dark, the tarsi also conspicuously darker than tibiae; abdominal bands broad and entire, except the basal one on first segment; black area on first segment a transverse band, but its upper side convex, so that it is elongate-semilunar (but the lower side straight) and intermediate between the two types; lateral angles of black on second segment very acute; fifth segment without light hair at sides, its pygidial patch large and triangular; venter without pubescence; last ventral segment neither elongated nor concave in lateral profile.

♂. Smaller; clypeus not covered with hair, but dense white hair at sides of face; antennae black with third joint reddish on outer side; femora varying to mainly black; band at apex of first abdominal segment narrowly interrupted; apical plate broad and dark.

A very fine species, resembling *T. helianthi grandior* Cockerell but considerably larger and more robust, with longer axillae and broader apical plate of abdomen. The head is broader than in *grandior* and the pygidial patch is much broader apically.

***Triepeolus helianthi* Robertson**

The specimens separate into two lots, the larger or typical form, and a smaller variety or race, 8.5–9.5 mm. long. The latter is probably parasitic on a smaller host-species, but it seems to have no special character aside from size. Perkins observed that the British *Epeolus cruciger* Panzer lived with *Colletes succincta* and *C. marginata*, and those with the latter species were found to be of smaller average size.

Larger Race

COLORADO: 1 ♀, Wray, about 3700 ft. alt., at *Helianthus*, August 18, 1919; 3 ♀, La Junta, about 4100 ft. alt., along roadsides, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♀, Glenwood Springs, about 5800 ft. alt., among sweet-clover and sunflowers near town, August 5, 1920.

Smaller Race

COLORADO: 1 ♀, 1 ♂, Wray, about 3700 ft. alt., on dry upland near town, August 17, 1919; 2 ♀, La Junta, about 4100 ft. alt., along roadsides, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♀ (July 29, 1919), 1 ♂ (August 5, 1920), Glenwood Springs, about 5800 ft. alt., among sweet-clover and sunflowers near town; 1 ♀, Palisades, not far from Grand Junction, about 4740 ft. alt., July 18, 1919, collected by Pearce Bailey, Jr.; 1 ♀, Rifle, about 5400 ft. alt., at edge of swamp along R. R., July 20, 1919, collected by Herbert F. Schwarz; 1 ♀, 1 ♂, Boulder, about 5400 ft. alt., in town (collected by Pearce Bailey, Jr.) and on the plains near Boulder Lake, August 7-12, 1919.

The two races do not seem to have been living in different environments. The males run in my key in Journ. N. Y. Ent. Soc., XXVII, p. 300, to subspecies *pacificus* Cockerell, except that they are smaller, with more slender antennæ. They belong to the smaller race, whereas *pacificus* type is of the larger. I gather from Robertson's account that both sexes of his *helianthi* have the pleura marked alike; I have only a female from him. It remains to be decided whether I should not have separated *pacificus*, or whether all the Colorado specimens (excluding *grandior*) should be referred to it, as a distinct western subspecies.

Triepeolus schwarzi,¹ new species

COLORADO: 3 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

♂. Length 8-9 mm.; black, with cream-colored ornaments; labrum and mandibles (except apex) red; face with dense snow-white hair; clypeus densely granular and dull without a smooth line; eyes very pale grayish-green; sides of vertex with large punctures; antennæ black, third joint obscurely reddish; mesothorax with hair-band round margin (except in anterior middle) and two very broad parallel well separated bands (not sharply defined) reaching beyond center, for half their length connected with lateral bands by a thin inconspicuous pubescence; scutellum flattened; axillæ small, black; pleura densely covered with creamy-white hair, except on area above middle coxæ; tegulae dull apricot-color; wings hyaline, brownish apically, nervures and stigma piceous; legs clear bright ferruginous; spurs black; abdominal bands broad and entire, but that on first segment, or first three segments, notched in front; black area on first segment a transverse band, obtuse at sides; angles of black at sides of second segment rounded, but at end of a long sinus, the lobes of hair-bands being long and pointed, directed mesad; apical plate

¹Named after Mr. Herbert F. Schwarz, who was a member of the 1919 expedition, and has done much work on the bees collected.

red, very narrow; venter with appressed silvery-white hair, forming a broad triangle on first segment, and very broad bands (not emarginate posteriorly) on second and third.

A neat little species, running in my table in Ann. Mag. Nat. Hist., January 1904, to *T. isocomæ* Cockerell, but the markings are differently colored, the labrum is different, the scutellum different, etc. There is real affinity with the Californian *T. callopus* Cockerell, but the tubercles and clypeus are black, and there are other differences. It differs from *T. rohweri* Cockerell by the entirely red anterior femora and tibiæ (black in *rohweri*) etc.

***Triepeolus balteatus*, new species**

COLORADO: 1 ♂ (the type), Denver, August 28, 1919, collected by Barbara M. and Marjorie D. Schwarz; 1 ♂, White Rocks, an interesting cretaceous formation in the plains near Boulder, about 5200 ft. alt., at *Solidago*, August 13, 1919, collected by Mrs. T. D. A. Cockerell.

♂. Length about 9 mm.; black, including labrum, mandibles (except dark red band in middle), antennæ (third joint dark red on outer side), tubercles and axillæ; tegulæ pale testaceous; legs bright ferruginous, with black spurs; eyes entirely pea-green; face densely covered with silver-white hair, but pubescence in general cream-color; mesothorax covered with not very dense appressed hair, the two bands (parallel and reaching anterior margin) indicated by denser hair, but not very evident, posteriorly a dark semicircle (the concavity cephalad) indicates a nearly bare region; scutellum rather feebly bilobed, axillæ short; pleura densely covered with silvery-white hair; wings hyaline, faintly dusky, stigma and nervures piecous; hair on inner side of hind tarsi light orange (it is black in *T. isocomæ*); abdominal bands broad and entire; first segment with a transverse dark band, narrow, obtuse at ends; lateral angles of black on second segment right angles; apical plate dark reddish, broader than in *T. schwarzi*, its sides not parallel; second and third ventral segments with broad bands of silvery hair, not emarginate posteriorly.

Allied to *T. denverensis* Cockerell but much smaller, with the sides of the second abdominal segment entirely covered with light hair, the hair on pleura white instead of creamy, etc.

***Triepeolus rhododontus*, new species**

COLORADO: 1 ♂, Wray, about 3700 ft. alt., at the head of Dry Willow Creek, August 18, 1919.

♂. Length about 9.5 mm.; black, with labrum (except basal middle), mandibles (except apex), tubercles, ends of axillæ and legs ferruginous, the hind femora with a large blackish patch in front; clypeus bare, dully minutely rugosopunctate, without a median line or ridge; face otherwise densely covered with pure white hair; eyes pale gray; antennæ black; mesothorax dull and rough, margined with ochreous hair except in anterior middle, the stripes dagger-shaped but not sharply defined, with the broad base on anterior margin; scutellum moderately bilobed; axillæ dentiform, curved, acute; pleura with a crescentic transverse band of white hair, the space below it nearly bare and strongly punctured, with a shining median area; tegulæ apicot-

color, dull; wings brownish, stigma and nervures piceous, marginal cell rather unusually short and broad; spurs black; hair on inner side of hind tarsi fulvous; abdomen with pale ochreous bands, only that at base of first segment interrupted, but that at apex of first notched before and behind, almost interrupted; black area on first segment a transverse band, rounded at sides; lateral angles of black on second acute, the lateral hair-patches pointed mesad; apical plate red, parallel-sided; venter largely reddish, but second segment black except the broad margin, a crescent of thin whitish hair at each side of second and third segments.

Allied to *T. occidentalis* Cresson (a specimen from Cresson's collection compared) but distinguished by the red labrum, tubercles and axillæ, the smooth space on pleura, the narrow, parallel-sided apical plate, etc.

***Triepeolus* (*Synepeolus*, new subgenus) *insolitus*, new species**

COLORADO: 1 ♂, Pueblo, in a vacant lot in town, August 9, 1920.

♂. Length about 12 mm.; robust; black, including antennæ, tubercles and axillæ, but labrum and median band on mandibles red; legs chestnut red, the anterior femora black except at apex, spurs black, hair on inner side of basitarsi black; tegulæ piceous, dark rufous posteriorly. Head broad; eyes with lower half purplish, upper half green; clypeus exposed, very densely and minutely punctured, with a smooth median line and a few scattered large punctures; face at each side of antennæ with a longitudinal band of white hair, but on front and between antennæ it is dark grayish; third antennal joint obscurely rufous at end; thorax and abdomen with ochreous ornaments; black area on mesothorax anchor-shaped, the lateral arms or lobes very broad, the bands of ochreous hair pointed posteriorly (style of *T. fortis*, but stem of anchor more slender); scutellum bilobed, axillæ short and obtuse; wings brownish, stigma and nervures piceous; only two submarginal cells, the second transverse cubital absent, but first recurrent nervure joining second submarginal cell near base, the second submarginal cell not as long as if a typical *Triepeolus* had lost a nervure; the first transverse cubital is transverse, not oblique as in typical *Triepeolus*; pleura densely punctured, with a pale dull-ochreous L-shaped pubescent mark; abdomen with rather narrow ochreous bands, that at base of first segment broadly interrupted, that on apex of first emarginate anteriorly and posteriorly, that on second slightly emarginate posteriorly; dark area on first segment shaped nearly as in *T. fortis*, but not so broad, and truncate at sides, the pale pubescence at sides of segment nearly twice as broad as that at apex; angles of black at sides of second segment slightly acute, the lateral hair-patches broadly rounded; apical plate dark reddish, fairly broad, with concave margins; venter black, with a little white hair in middle of fringes on fourth and fifth segments, and sixth red in middle.

Resembles *T. fortis*, but smaller, with red middle and hind femora, much shorter fourth antennal joint, etc. From the position of the first transverse-cubital nervure, the condition of two submarginal cells is evidently normal and the insect falls in a new subgenus, which may be called ***Synepeolus***, from the united submarginal cells. *Phileremus americanus* Cresson is not related, but is an Epeoline with two submarginal cells. Ducke (1908) called it *Epeolus americanus*.

***Triepeolus brunneus*, new species**

COLORADO: 1 ♀, Lawn Lake, Rocky Mountain National Park, about 10,000 ft. alt., August 22, 1919, collected by Herbert F. Schwarz.

♀. Length about or a little over 9 mm.; rather robust; black, with cream-colored ornaments, but the usually black areas on mesothorax, scutellum, pleura and abdomen wood-brown from a covering of fine pile, but the area of metathorax exposed and black, the hair at sides of metathorax white; a large tuft of pale orange hair proceeding from behind each wing mesad over sides of postscutellum; cheeks with a strong abrupt keel behind. Labrum black; mandibles red in middle; clypeus very minutely and densely punctured, with scattered larger punctures, and no median smooth line; eyes purplish, greenish above; antennae long, black, third joint red in front; prominence between antennae strong; sides of face with white hair, becoming yellowish above; mesothorax with ochreous hair on lateral and posterior margins, and a pair of discal stripes, narrowed anteriorly but almost reaching anterior margin; scutellum faintly bilobed, axillae very small, but pointed; tegulae dark rufous, hairy; wings hyaline, slightly brownish apically; stigma and nervures rufofuscous; marginal cell unusually short; upper part of mesopleura with white hair, lower part brown, the two colors not sharply separated; legs bright ferruginous, middle and hind spurs black; hair on inner side of hind tarsi pale orange; abdominal bands broad and entire, including basal one of first segment; brown area on first segment a transverse band with straight margins and obtusely rounded ends; lateral hair-patches rounded; pygidial area rather large, the segment covered with light hair on each side of it; venter brown without markings, the hind margins of the segments appearing very narrowly pallid; last ventral segment normal.

A very peculiar species, not close to any other, but similar brown pile may be seen in *Argyroselenis minima* Robertson, and to some extent in other Epeolines. It tends to be denuded as the specimens grow old.

***Triepeolus trilobatus*, new species**

COLORADO: 1 ♂, White Rocks (see above) near Boulder, about 5200 ft. alt., August 13, 1919.

♂. Length about or a little over 12 mm., robust; black, including labrum, mandibles (except red band in middle), antennae, tubercles, axilla and legs, the hind femora with a red spot behind near apex, and their tibiae with a large red patch on inner side apically; hair on inner side of hind tarsi rather pale chocolate; spurs black; ornaments of head and thorax cream-color, but hair at sides of face (not covering clypeus) pure white; eyes green, lower third purplish; clypeus dull and minutely granular, without a smooth line, its upper corners covered with brown hair; fourth antennal joint longer than fifth; mesothorax dull, margined with ochreous except in middle anteriorly, the black area like a large trilobed leaf, but the middle lobe long and narrow and reaching margin, the bands of pubescence pointed and not very long; scutellum bilobed; axillae stout-conical; upper part of pleura with dense ochreous hair, more or less L-shaped (the transverse band very broad), the lower part black and dull, shining between the punctures in middle; tegulae piceous, the margin reddish posteriorly; wings brownish, stigma and nervures piceous, first recurrent nervure reaching second submarginal cell a little before middle; middle tibiae with a stripe of shining fulvous hair on outer side; abdomen with broad entire bands, basal one on

first segment narrowly interrupted; black area on first segment a broad triangle; lateral corners of black on second segment acute, the edge of the pubescence above (cephalad of) them convex; band on sixth segment white; apical plate broad, very dark reddish; venter black, margins of third segment with silver-white hair laterally.

Resembles *T. concolor* Robertson, but differs greatly in ornamentation of mesothorax, which is similar to that of *T. fortis*. The apical plate is more narrowed apically than in *fortis*, but the relationship is very close, much like that of *concolor* to *lunatus*. Robertson described *concolor* in 1898 as a variety of *lunatus*, but in 1903 treated it as a distinct species.

***Triepeolus perelegans*, new species**

ARIZONA: 1 ♂, Comobabi Mts., about 32° 1' N., 111° 42' W., on the road from Haynes Well to the Indian village of Cobabi, about 3400 ft. alt., mesquite-acacia country, August 9, 1916.

♂. Length about 10 mm.; slender; black, with first three antennal joints and base of fourth, and all the legs, very bright ferruginous; spurs black (red in *T. hopkinsi* Cockerell), hair on inner side of hind tarsi orange; labrum red, mandibles suffusedly reddish; tubercles and axillæ black; ornaments very pale, with a creamy tint, hair of face, upper part of pleura and sixth abdominal segment white; eyes green, purplish at lower end. Clypeus with the disc flattened, shining, very minutely punctured, with scattered larger but not strong punctures; mesothorax glistening, black, with a pair of rather short, widely separated stripes, not reaching anterior margin; marginal band only along posterior side, and a patch before each tegula; scutellum bilobed, axillæ very inconspicuous; pleura with white hair above, below shining, with well-separated punctures; tegulæ bright ferruginous; wings hyaline, slightly brownish, stigma ferruginous, nervures fuscous; first recurrent nerve joining second submarginal cell beyond middle; abdomen with the bands very slightly yellowish, approaching pure white, basal and apical ones on first segment with linear interruptions, the others entire; black area on first segment a broad transverse band the ends oblique; lateral angles of black on second acute, the lateral hair-patches rounded; apical plate rather broad, very dark reddish; venter with bands of silver-white hair (successively narrower, and not emarginate posteriorly) on segments 2 to 4, the two fringes of curled hairs pale brown (the second darker than the first), some silver-white hair at sides of margin of fifth segment.

A pretty and distinct species, known from *T. hopkinsi* Cockerell, from the Grand Canyon of the Colorado, by the color of the spurs, the sparsely punctured lower part of pleura, etc. *T. pimarum* Cockerell, also from Arizona, has the clypeus red, and the mesothorax red with a broad median black band.

***Triepeolus sequior*, new species**

COLORADO: 1 ♂, Ridgeway, about 7000 ft. alt., sagebrush country, July 15, 1919, collected by Herbert F. Schwarz.

♂. Length about 9.5 mm.; black, including labrum, mandibles (except dark red median band), antennæ, tubercles, axillæ and spurs, but legs bright ferruginous,

with anterior femora (except knees) and their tibiae in front (except apex) black; hair on inner side of hind tarsi pale orange; ornaments cream-color, but face densely covered with silver-white hair, though the band on sixth abdominal segment is colored like the rest; eyes entirely dull pale green; fourth antennal joint conspicuously longer than fifth; mesothorax bordered with rather long and shaggy ochreous hair, the band very narrow along posterior middle, but not broken in middle anteriorly, the longitudinal bands pointed dentiform projections, the black area anchor-shaped; scutellum bigibbous; axillae small; mesopleura densely covered with creamy-tinted hair; tegulae piceous, with narrow obscure reddish margins; wings brownish, stigma and nervures (except basally) piceous; abdomen with all the bands broad and entire except that on apex of first, which is narrowly interrupted, the black area on first segment a transverse band; lateral angles of black on second acute (about 50°). The lateral patches of hair pointed, with the side above the angle straight (in *T. perelegans* it is convex); apical plate dark red, narrow; second and third ventral segments with very broad pure white hair-bands, slightly notched in middle posteriorly; fourth with white hair basally the two long curled fringes dull pale yellowish (dark fuscous at ends in *T. rhododotus*).

An ordinary-looking species, easily known from small examples of *helianthi* by the entirely hairy pleura, in the manner of *T. cressoni* Robertson. From *T. fraseræ* (Cockerell) it is easily known by the smaller size, the narrowly (instead of widely) interrupted apical band on first abdominal segment, the ochreous band along front of mesothorax not interrupted, and the much narrower apical plate. *T. fraseræ* also has the anterior tibiae entirely clear red. *T. fraseræ* is from Beulah, New Mexico, in the Canadian Zone. *T. sequior* is from the Transition Zone, about 7000 ft.

***Triepeolus rectangularis*, new species**

UTAH: 1 ♀, 1 ♂, Huntsville, near Ogden, July 26, 1920.

♀. (Type). Length about 11 mm., robust; black, including labrum, mandibles (except dark red median band), tubercles, axillae and legs, but small joints of tarsi red; third antennal joint (except basal two-thirds of inner side) and base of fourth bright chestnut red; tegulae piceous, the margin partly reddish; wings strongly dusky, stigma and nervures (except basally) piceous; outer transverse cubital angled and more or less appendiculate in middle; eyes dark purplish, the upper two-fifths light green; face at each side of antennae with appressed silvery hair; clypeus dull and minutely granular, with scattered large punctures, and a median ridge descending about three-fifths from the top; fourth antennal joint conspicuously longer than fifth; ornaments of thorax and abdomen cream-color; mesothorax with band along posterior and lateral margins, at anterior corners a quadrate patch of hair, emitting a nearly or quite obsolete bridge of hair to lateral stripes, thus enclosing a triangular black marginal area on each side; longitudinal stripes long and broad, diverging posteriorly, pointed, the base not quite reaching mesothoracic margin; scutellum bilobed, axillae short; pleura with a large L-shaped mark of light hair, but it is irregular, its upper part very broad, and extending beneath wings, while its lower edge is concave; lower part of mesopleura densely punctured but glistening; hair on inner side of hind tarsi

orange, on mid-tarsi tinged with coppery; spurs black; abdominal bands broad and entire, that on apex of first with a broken linear interruption; black area on first segment a transverse band, very obtuse laterally; lateral angles of black on second segment rectangles; false pygidium large, the segment on each side covered with pale hair; last ventral segment normal; venter without bands.

♂. Length about 8.5 mm., slender; red on antennæ reduced to apex of third segment and base of fourth; stripes on mesothorax shorter; mesopleura covered with pale hair; both bands on first abdominal segment narrowly interrupted, all the abdominal bands of the same color; apical plate piceous, narrow and parallel sided; second and third ventral segment with rather narrow bands of shining white hair, concave in middle and convex at sides, regarded from behind; the two fringes of curled hairs very dark; eyes entirely pea-green.

These look like different species but doubtless belong together. The sexual difference in the clothing of the pleura is similar to that in *T. cressoni* Robertson. This may be compared with *T. wyomingensis* Cockerell, a black-legged species with the lateral angles of black on second segment right angles. *T. wyomingensis* has a much larger male, without the red on antennæ, with a large part of pleura bare, and the white bands on venter very broad and quite different. It also has much longer, shaggy hair on mesothorax.

***Tripeolus amandus*, new species**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

♂. Length about or nearly 10 mm., rather slender; black, with very pale creamy-tinted ornaments, the band on sixth abdominal segment clear white; labrum, mandibles (except red median band), antennæ (except third joint partly reddened), tubercles, axillæ and legs (with spurs) black; face densely covered with silver-white hair; fourth antennal joint very slightly longer than fifth; mesothorax with rather loose ochreous hair forming a complete band all around, the longitudinal stripes hardly differentiated, the spaces laterad of them, nearly to their posterior ends, filled with hair, while the space between them is largely filled, though all this hair is rather thin; scutellum bilobed; axillæ small; mesopleura covered with white hair, slightly creamy above; tegulæ small, chestnut red; wings hyaline, faintly brownish apically, stigma and nervures (except basally) piceous; tibiæ and basitarsi with brilliant silvery-white appressed hair, middle tibiæ with a stripe of orange hair; hair on inner side of hind tarsi dusky ferruginous; abdomen with all the bands entire; black area on first segment a narrow transverse band, rounded at ends and sharply defined; lateral angles of black on second segment right angles; apical plate dark red, pointed; second and third ventral segments with broad white hair-bands; curled fringes very dark brown.

Also to be compared with *T. wyomingensis*, differing in the pointed apical plate, the broadly rounded ends of black band on first segment, the red tegulæ, etc. The upper appendiculation of third transverse cubital is wanting, whereas it is very prominent in *wyomingensis*.

***Triepeolus lestes*, new species**

COLORADO: 1 ♀, Glenwood Springs, about 5800 ft. alt., at edge of town, July 29, 1919, collected by Pearce Bailey, Jr.

♀. Length about 10 mm.; black, with black legs and cream-colored ornaments, small joints of tarsi obscurely pale reddish; eyes purplish with the upper third green; apex of third antennal joint on outer side dark red; fourth joint conspicuously longer than fifth. Similar to *T. rectangularis*, but differing thus: scattered punctures of clypeus fewer and much weaker, and no median ridge; stripes on mesothorax consisting of two elongated marks (style of *T. helianthi*), entirely isolated from the marginal band, which hardly goes mesad of the anterior corners; scutellum not distinctly bilobed; transverse band on pleura narrow and pointed; both hands on first abdominal segment narrowly interrupted; lateral hair-patches on second segment reduced to triangular projections from the band; transverse black band on first segment slightly bulbous at ends; false pygidium smaller.

***Triepeolus dichropus*, new species**

COLORADO: 1 ♂, Glenwood Springs, about 5800 ft. alt., at edge of town, July 29, 1919, collected by Herbert F. Schwarz.

♂. Length about 11.5 mm., robust; black, including labrum, mandibles (except median dark red band), antennae, tubercles and axillae; tegulae piceous, dark rufous on outer side; hind tibiae and tarsi bright ferruginous; all the knees, hind femora behind, anterior tibiae apically, and their tarsi, more dusky red; spurs black; hair on inner side of hind tarsi orange; ornaments cream-color. A little pure white hair at each side of antennae; clypeus dull and granular, with no median line, the scattered larger punctures few and shallow,* mainly confined to the apical region; cheeks with a strong posterior keel; mesothorax glistening in middle, the marginal band narrow and weak, failing in anterior middle, and at sides of middle arching away from margin, the longitudinal stripes indistinct and short, but reaching anterior margin; scutellum bilobed, axillae moderate; mesopleura dull, rugose, with a broad band of pale ochreous-tinted hair down its anterior margin, this sending only a small, curved, tooth-like projection backward; wings hyaline, faintly brownish, stigma piceous, nervures fuscous, paler basally; marginal cell long and unusually parallel-sided; outer transverse cubital angular; abdomen with broad entire bands, all of the same color; black area on first segment a broad transverse band, somewhat pointed at sides; band on second segment having at sides lateral lobes shaped like the last joint of a finger, standing at right angles to the band; apical plate piceous, rather narrow; second and third ventral segments with rather narrow bands of white hair, not emarginate posteriorly; curled fringes ochreous with dark tips.

An ordinary form in general aspect, but with many distinctive characters.

***Triepeolus maculiventris*, new species**

COLORADO: 1 ♀, Navajo Canyon in Mesa Verde National Park, about 6400 ft. alt., at *Helianthus petiolaris*, July 5, 1919.

♀. Length 10.3 mm.; black, with the labrum and mandibles dark red; tubercles and axillae black; legs chestnut red, with the anterior femora black; spurs black; hair on inner side of hind tarsi orange, very short; tegulae shining black; wings

hyaline, dusky apically, stigma and nervures black, the latter basally fuscous; ornaments cream-color, sharply defined, but face in region of antennæ with appressed white hair; clypeus finely and minutely punctured, but glistening, with scattered weak larger punctures, and a delicate smooth median line; antennæ black, third joint dusky reddish apically and on outer side; fourth joint longer than fifth; mesothorax with posterior marginal band broad behind tegulae, but narrowing to a line in posterior middle; in front of tegulae is a broad triangular-cuneiform patch, not joining posterior band or reaching anterior margin; longitudinal stripes distinct and clear-cut, lanceolate, parallel, not reaching anterior margin; scutellum feebly bigibbous, axillae rather large, pointed; pleura with a clear-cut L-shaped mark, but it is excavated posteriorly behind tubercles, its lower (transverse) arm is parallel-sided and truncate; lower part of pleura densely punctured, but glistening between the punctures, except at upper end; abdomen with very distinct bands, both those on first segment narrowly interrupted, that on second slightly notched posteriorly; black area on first segment a broad band, obliquely truncate at ends; lateral angles of black on second segment broadly rounded, but the lateral marks are obliquely directed mesad, their outer face very convex, the inner straight; false pygidium moderate, with a large clear-cut triangular patch on each side; venter black, with a sharply-defined patch of white hair at each side of margin of third segment, and a pair of linear marks on fourth; eyes pale green, the lower third purplish.

Distinct by the pattern of the mesothorax, and white spots on venter, together with the red legs and dark tegulae. The last ventral segment is normal, not concave in lateral profile.

***Triepeolus laticaudus*, new species**

COLORADO: 1 ♀, Cascade, Ute Pass, August 22, 1914, collected by D. M. Fisk.

♀. Length 9 mm., slender; black, including labrum (except a pair of obscure red spots), mandibles (except broad red band), antennæ (except reddish apex of third segment), tubercles and axillae; tegulae lively red, with a large black spot in front, and broad hyaline margins; legs bright red, but anterior femora black except apex and a stripe beneath, and middle femora black above, spurs black; hair on inner side of hind tarsi very pale yellowish; eyes pale green, with a grayish or purplish area below middle, but hind margins broadly green throughout; ornaments cream-color, but white hair around antennæ. Clypeus shining, very finely punctured, with scattered weak larger punctures, but no median smooth line, the basal two-thirds of middle flattened; fourth antennal joint longer than fifth; mesothorax rugose, with the marginal band feebly developed, the discal stripes long and narrow, parallel and wide apart, very nearly reaching anterior margin; scutellum strongly bigibbous; axillae large; pleura with an L-shaped mark, but the broad lower arm curved, the convexity below; the ochreous hair extends down the front of mesopleura below the corner of the L; lower part of pleura densely and finely punctured, not shining; wings brownish hyaline, stigma and nervures black; abdomen with bands rather narrow, apical one on first segment rather widely interrupted in middle, that on second with a linear interruption; black area on first segment a very broad band, obliquely truncate at sides, but the outermost ends obtuse; lateral hair-marks on second segment reduced to isolated oblique spots, not united with the band; false pygidium very large; last ventral segment normal; venter with weak hair-bands on segments 2 to 4, and the fifth covered, except at sides, with pale appressed hair.

Known by the abdominal pattern, and especially the pale hair on last ventral segment; the tegulae also are very distinctive.

***Triepeolus alpestris*, new species**

COLORADO: 1 ♀, Leadville, about 10,200 ft. alt., in vacant lots in town at *Lepidium allysoides*, August 4, 1919, collected by Herbert F. Schwarz.

♀. Length 9 mm.; black, including labrum, mandibles (except obscure red band), antennae (except red outer side and apex of third joint), tubercles and axillae; tegulae shining rather dark red; wings brownish hyaline, stigma and nervures black; marginal cell appendiculate at end; eyes with lower third purplish, upper two-thirds pale green; anterior legs black with small joints of tarsi red; middle femora black above and red beneath, their tibiae black, except at apex; hind femora red, with a dusky band along anterior side, their tibiae black, reddish on inner side; middle and hind basitarsi black, small joints red; spurs black; hair on inner side of hind tarsi appearing copper-colored seen from one direction, pale yellow seen from another; clypeus dully minutely punctured, with scattered very weak large punctures, and no median line; ornaments cream-color, but white hair at sides of face; mesothorax with anchor-shaped black area, the lateral bands in front pointed mesad, and only separated by a line from the broad-lanceolate discal marks, which do not reach anterior margin; scutellum convex, feebly bigibbous; axillae small; pleura covered with hair, except the disc below, which is densely punctured and dull, the exposed area not distinctly defined; abdominal bands entire except the apical one on first segment, which has a linear interruption; black area on first segment a transverse band, evenly rounded at ends; lateral angles of black on second segment approximately right angles; pygidial area moderate; last ventral segment normal; venter with thin pale hair-bands on second and third segments. Known by the pattern of mesothorax and abdomen, combined with the color of legs and character of mesopleurae.

It is allied to *T. townsendi* Cockerell, from the White Mountains of New Mexico, but easily separated by the much darker legs and the broad second submarginal cell. In *townsendi* the longitudinal stripes of mesothorax continue broadly to the anterior margin. Comparison may also be made with *T. concinnus* Cockerell from Northern Mexico, but that is larger, with yellower markings, and the middle and hind femora and tibiae entirely bright red.

The above species of *Triepeolus* bees may be separated by means of the following table. I include also the few species of *Epeolus*.

Scutellum red.....	<i>E. bifasciatus</i> Cresson.
Scutellum black.....	1.
1. Legs black.....	2.
Legs at least mainly or largely red.....	9.
2. Large species, with mesothorax broadly ochreous-haired anteriorly, without longitudinal stripes; apical ventral segment of ♀ strongly concave in lateral profile.....	<i>T. concavus</i> (Cresson).
Mesothorax with two longitudinal stripes, or if these are indistinct, species small; apical ventral segment of known females not concave in lateral profile....	3.

3. Black area on first abdominal segment triangular or subtriangular 4.
Black area on first abdominal segment a transverse band 6.
4. Length under 10 mm.; stripes on mesothorax not separated from light hair of margin *E. utahensis* Cockerell.
Length 10 mm. or more 5.
5. Stripes on mesothorax small and entirely isolated . . . *T. concolor* (Robertson).
Stripes on mesothorax continuous with marginal pubescence.
T. trilobatus Cockerell, ♂.
6. Tegulae dusky red; no separate stripes on mesothorax . . . *T. amandus* Cockerell.
Tegulae black or almost; distinct stripes on mesothorax 7.
7. Venter with two very distinct white hair-bands . . . *T. rectangularis* Cockerell. ♂.
Venter without white hair-bands 8.
8. Clypeus with a median ridge, and very large scattered punctures.
T. rectangularis Cockerell, ♀.
Clypeus with no median ridge, and small scattered punctures.
T. lestes Cockerell, ♀.
9. Dark area on first abdominal segment triangular or subtriangular 10.
Dark area on first abdominal segment a transverse band 11.
10. Tegulae black or piceous; only two submarginal cells . . . *T. insolitus* Cockerell.
Tegulae dusky red; dark area on first segment somewhat intermediate in type; three submarginal cells *T. fortis* Cockerell.
Tegulae clear red *T. lunatus* (Say).
11. Dark areas of abdomen entirely covered with brown pile; tegulae red; labrum black *T. brunneus* Cockerell.
Abdomen normal 12.
12. Mesothorax without distinct stripes; small or smallish species; tegulae red or testaceous; pleura densely covered with light hair 13.
Mesothorax with distinct stripes, but they reach anterior margin 14.
Mesothorax with a pair of entirely isolated stripes 22.
13. Over 8 mm. long; lateral angles of black on second abdominal segment right angles or larger *T. balteatus* Cockerell.
Less than 8 mm. long; lateral angles of black on second segment acute.
E. lutzii Cockerell.
14. Longitudinal stripes of mesothorax joining marginal band of pale pubescence. 15.
Longitudinal stripes of mesothorax not joining marginal band 18.
15. Smaller; tegulae clear red 16.
Larger; tegulae dusky red to piceous 17.
16. Lower part of pleura not covered with hair; axillae red at end.
T. rhododontus Cockerell.
Lower part of pleura covered with hair; axillae short and black.
T. schwarzi Cockerell.
17. Lateral angles of black on second abdominal segment right angles; apical plate narrower *T. dichropus* Cockerell, ♂.
Lateral angles of black on second abdominal segment acute; apical plate broader *T. fortis*, Cockerell, ♂.
Much smaller than *fortis*, with shorter axillae and longer fourth antennal joint, and whole mesopleura densely covered with hair . . *T. sequior* Cockerell, ♂.
18. Axillae red *E. pusillus* Cresson.
Axillae black; scape black 19.

forming an acute inner angle with band; apical plate narrow; second and third ventral segments with very broad hair-bands which in some lights appear silvery-white (not at all ochreous), that on second strongly emarginate, almost divided, in middle posteriorly.

Related to *E. hitei* Cockerell, but much less robust, and with black legs and antennæ.

***Epeolus lutzi*, new species**

COLORADO: 3 ♂, Walsenburg (type locality), about 6200 ft. alt., Sabina-pinyon country, June 14, 1919; 1 ♂, Regnier, along the state border south of Lamar, about 4400 ft. alt., pasture land, June 7, 1919. UTAH: 1 ♂, Salt Lake City, about 5000 ft. alt., near Fort Douglas, July 28, 1920.

♂. (Type) Length 6.5-7.5 mm.; black, with pale ochreous markings, the dense hair covering face pure silvery white; tegulæ apricot-color; mandibles broadly bright chestnut-red in middle; antennæ black, third joint obscurely rufous apically; legs bright ferruginous, with appressed white hair, but anterior femora black except apically, and anterior tibiæ broadly black in middle; eyes pale green, orbits strongly converging below; labrum black, reddish apically; mesothorax densely punctured, thinly covered with pale ochreous hair, which is denser along the margins, and shows anteriorly two nebulous broad converging bands, not reaching the center; scutellum moderately bigibbous, axillæ pointed; pleura covered with light hair; wings hyaline, dusky apically, stigma dark red; nervures fuscous, red basally; spurs clear red; abdomen with broad entire bands, but those on first two segments strongly emarginate anteriorly, their anterior margin on each side of the incision convex; black area on first segment a transverse band, very obliquely truncate at each side; band on second segment with large round lateral lobes, making an acute angle with the band; anterior (basal) margin of bands on third and fourth segments strongly undulate; apical plate very broad, bright red; venter broadly covered with pure white hair in middle, and also on hind margins of first three segments, leaving large black sublateral subquadrate areas.

♂. Similar, but differing thus: eyes dark purplish, green above; third antennal joint wholly black; mesothorax with the area not covered by the broad converging (basal) longitudinal bands and marginal pubescence black, not covered with pale hair, there is a black triangular area anteriorly, between the bands; fifth segment abdomen with the usual broad silvery lunule.

***Epeolus lutzi dimissus*, new race**

COLORADO: 1 ♀, Leadville, about 10,200 ft. alt., in a vacant lot in town, August 4, 1919.

Smaller, length 6 mm.; middle femora black, with the apex broadly red; hind femora somewhat dusky; bands on mesothorax shorter and less distinct; tegulæ smaller, shining; hair of abdomen whiter, the black area on first segment less sharply defined.

A race of high altitudes. *E. lutzi* is less coarsely punctured than *E. hitei* Cockerell, and differs in the color of the antennæ and other characters. It is larger than *E. humillimus* Cockerell, which has interrupted abdominal bands, and widely separated stripes on mesothorax.

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WESTERN BEES OBTAINED BY THE AMERICAN MUSEUM EXPEDITIONS

By T. D. A. COCKERELL

This is the third report¹ upon the bees obtained in the course of the American Museum's entomological survey of the Western States. It includes parasitic bees and Panurgidæ. Unless otherwise stated, the specimens were collected by Frank E. Lutz and the field notes are by him.

NOMADA Scopoli

Nomada crucis Cockerell

UTAH: 1 ♀, 2 ♂, Salt Lake City, about 5000 ft. alt., near Fort Douglas, July 28, 1920, collected by Mrs. F. E. Lutz. COLORADO: 1 ♀, Grand Junction, about 4500 ft. alt., in a vacant lot near the Fair Ground, August 3, 1920.

Described from the Mesilla Valley of New Mexico, and considered a Middle Sonoran species. The specimens from Utah and Colorado are quite typical. Swenk records it from Arizona. In Texas it intergrades with *N. texana* Cresson.

Nomada vincta Say

COLORADO: 5 ♀, 7 ♂, Wray, about 3700 ft. alt., both sexes at *Helianthus*, one male taken by evening sweeping in a relatively moist place along the river, some collected by Pearce Bailey, Jr., August 17, 1919; 1 ♀, Boulder, about 5500 ft. alt., in a vacant lot in town, August 8, 1919.

Common in Eastern Colorado, but I did not take it in New Mexico.

Nomada vincta heterochroa, new variety

COLORADO: 2 ♂, Wray, about 3700 ft. alt., one taken with the typical form in evening sweeping and one in a moist place at the head of Dry Willow Creek, August 17 and 18, 1919.

Mesothorax red, with a large cuneiform black mark, having its base on posterior margin; mesopleura red, except for the yellow patch; base of abdomen and bands red instead of black, sometimes with black at bases of second and third segments.

A color-variety, not a race, but very distinct in appearance.

¹For the preceding reports see American Museum Novitates, No. 21, December 1, 1921, and No. 23, December 5, 1921.

Nomada zebrata Cresson

COLORADO: 1 ♂, 1 ♀, Wray, about 3700 ft. alt., in more xerophytic places than were *vincla*, the female at *Helianthus*, August 18, 1919; 1 ♀, Boulder, about 5500 ft. alt., in town, August 8, 1919.

Extends southward to the White Mountains of New Mexico.

Nomada gutierreziae Cockerell

COLORADO: 1 ♀, Pueblo, in a vacant lot in town, August 9, 1920.

Previously known from the Mesilla Valley, New Mexico. The anterior coxæ have very short but distinct spines.

Nomada morrisoni Cresson

COLORADO: 2 ♀, South Fork, about 8200 ft. alt., near the junction of the two headwaters of the Rio Grande, June 17, 1919.

One differs from the type in having the spots on metathorax entirely red and yellow band on first abdominal segment broadly interrupted. The other has the spots on metathorax yellow.

Nomada civilis Cresson

IDAHO: 1 ♂, Montpelier, about 6100 ft. alt., near town, July 6, 1920.

There are two large yellow spots on scutellum, but in some examples of *N. civilis* (for example, from Florissant, Colorado) these are absent.

Nomada cymbalariae Cockerell

COLORADO: 1 ♂, Mineral County, about 37° 27' N., 106° 54' W., near the junction of Wolf and Fall Creeks, about 7900 ft. alt., vegetation of oak, Engelmann spruce, etc., June 20, 1919.

This falls with the male which I have, without having definite proof, regarded as belonging to *cymbalariae*. It differs from a Florissant specimen in lacking the upper (somewhat enlarged) ends of lateral face-marks, in not having distinctly red hair on scutellum, in the smaller and entirely yellow scutellar spots, and in the more obscure band on first abdominal segment. These differences might all fall within the limits of variation.

Nomada edwardsii Cresson

IDAHO: 1 ♀, Victor, about 6300 ft. alt., vegetation of aspens, roses, etc., July 11, 1920.

This is a member of the Pacific Coast fauna, extending inland to Idaho. The same is true of the next species, *N. citrina*. The Californian *N. coquilletti* Cockerell also reaches Idaho.

Nomada citrina Cresson

IDAHO: 1 ♀, Bear Lake, about 6200 ft. alt., along Fish Haven Creek, July 9, 1920.

In my table in 1903, Proc. Acad. Nat. Sci. Phila., LV, p. 582, this runs to *citrina* var., based on a specimen from Grangeville, Idaho.

Nomada pecosensis (Cockerell)

COLORADO: 2 ♀, Pagosa Springs, about 7700 ft. alt., in the U. S. forest reservation, June 21, 1919.

A little larger than the type. Previously known from Pecos, New Mexico, and Palisades, Colorado, taken in May and June.

Nomada accepta Cresson

COLORADO: 1 ♀, Aspen, about 8300 ft. alt., along Castle Creek, July 15, 1919, collected by Herbert F. Schwarz.

Nomada alpha Cockerell

This species differs from *morrisoni* in the red legs (with hardly any yellow), narrower face, and other characters (see Swenk, Univ. of Nebraska Studies, XII, p. 73), but both are very variable and I now incline to the opinion that they represent diverse forms of a single species. The matter will only be settled when we have larger series, including males. Typical *alpha* is from Fort Collins, Colorado, 4980 ft. alt.

Further confusion is introduced by the discovery of two additional forms of *alpha*, as follows.

Nomada alpha paralpha, new variety

COLORADO: 1 ♀, Walden, about 8400 ft. alt., among sagebrush on hillside, June 17, 1920.

♀.—Differs thus: length fully 10 mm.; mandibles not yellow basally; labrum yellowish, but clypeus and other face-markings pale red; red lateral face-marks continuous with stripes along posterior orbits, and with a swelling or lobe opposite the frontal spot; yellow behind eyes indistinct; scape red, with a black stripe behind; third antennal joint hardly longer than fourth; mesothorax with a very broad median black stripe, and narrower lateral ones, inclined to be slightly interrupted in middle, or one may say, black with four red stripes, the outer marginal; middle of pleura red, and a red spot beneath the wings; scutellum entirely red; anterior femora with a large black mark behind; first abdominal segment largely black at base; venter light red.

Nomada alpha dialpha, new variety

COLORADO: 2 ♀, Walden, about 8300 ft. alt. on the more mesophytic river-bottom among willows, cottonwood, Iris, etc., June 17, 1920.

♀.—Length, 9.3–10.3 mm.; similar to *paralpha*, the venter red, or with an obscure yellow band on fourth segment, but mesothorax red with a black triangle on

anterior margin. There is more red on front, the larger specimen having a broad red band right across. Red band behind eyes broader, without any yellow. Scape entirely red. Mesopleura almost entirely red, contrasting with the yellow tubercles. Anterior femora without black. First abdominal segment red, without black base or yellow spots.

These forms have some resemblance to *N. collinsiana* Cockerell, but are quite distinct.

***Nomada calloxantha*, new species**

WYOMING: 1 ♀, Stewart Ranger Station, in the Jackson Hole country at about 43° 42' N., 110° 45' W., about 6700 ft. alt., lodgepole pine, Engelmann spruce, etc., July 18, 1920.

♀.—Length about 12 mm.; bright sulphur yellow, marked with red and black; head broad, orbits somewhat converging below; eyes pale grayish, suffused with reddish, but on the upper third greenish; hair of head and thorax scanty, dorsum of thorax almost entirely nude; mandibles simple, yellow, black at end; lateral face-marks broad, extending over eyes to a broad stripe down posterior orbits, but interrupted by a large red patch on upper part of front; black marginal spots on clypeus, connected by a line with base of antennæ; region above and between antennæ blackened, but a transverse red band across front; vertex and posterior part of head black, a little red on occiput; antennæ stout; scape thick, yellow, partly red behind; flagellum entirely bright ferruginous; third antennal joint about as long as fifth, but conspicuously shorter than fourth; mesothorax coarsely rugose and dull, red, with yellow stripes over tegulæ and behind, and a median black band, narrow and faint in middle, triangularly expanded posteriorly, and less so in front; prothorax black, with the swollen upper margin and tubercles yellow; a small black area below wings; mesopleura yellow, with a transverse reddish stain on upper part, and a large red patch below; a broad black area behind mesopleura, bordered with red at sides of metathorax; metathorax with a broad median black band, the sides of the basal area having large yellow patches; scutellum and postscutellum yellow, the former strongly bigibbous; tegulæ pale yellowish, semitransparent; wings reddish, stigma and nervures ferruginous; basal nervure going a considerable distance basad of transverse median; third submarginal cell broad below; legs yellow; anterior trochanters and marks at base of femora red; middle coxæ mainly black, their trochanters red with a yellow spot, and their femora largely red at base; hind coxæ marked with red and black, their trochanters red, their femora mainly black on inner side, and with a red basal patch above, their tibiæ red on inner side except at base, their basitarsi with dense short light red hair on inner face; abdomen bright yellow; basal half of first segment red, with a median black mark; four rather narrow dark bands, the first two reddish, on apices of segments and adjoining bases; venter yellow, with two narrow dark bands, failing laterally.

A member of the subgenus *Xanthidium*, running in my tables to *N. morrisoni flagellaris* Cockerell, but certainly distinct. In Swenk's table of Nebraska species it runs to the much smaller *N. citrina flavo-marginata* Swenk, and in his further table of the same group (Univ. of Nebraska Studies, XII, p. 68) it runs nearest to *N. rufula* (Cockerell),

which was described as a variety of *citrina*. It differs from *rufula* in the venation and other characters and is, I think, certainly distinct. *N. rufula* is from Idaho.

***Nomada melanoptera*, new species**

COLORADO: 1 ♀, Wray, about 3700 ft. alt., on a dry hill near town, July 17, 1919.

♀.—Length about 11 mm., broad and robust; head black and red, thorax and abdomen black and bright lemon-yellow; mandibles simple; anterior coxæ without spines; third antennal joint long, much longer than fourth or fifth, but not as long as the two together; basal nervure meeting transverse median; abdomen strongly punctured. Head broad, facial quadrangle broader than long; eyes pale red; mandibles (except apex), labrum, lower margin and broader corners of clypeus, and entire sides of face ending obliquely a little above antennæ, bright ferruginous; face and front very coarsely punctured, clypeus with a smooth area on lower middle, supraclypeal area with very large sparse punctures; posterior orbits with a narrow red stripe, flushed with yellow at its upper end; antennæ with the first three joints bright red, the next three reddish, the rest black; mesothorax entirely black, very coarsely and densely punctured; prothorax black, with the thick upper border and the tubercles yellow; pleura very coarsely punctured, entirely black; metathorax all black; scutellum bigibbous, with two very large round yellow spots; postscutellum yellow; tegulæ bright red; wings dark fuliginous, with an irregular hyaline area in the subapical region, but the apical very dark; stigma ferruginous, nervures fuscous; legs bright red; hind tibiæ with a pointed posterior apical lobe, on the outer margin of which are four equal spines; abdomen broad, black, the first five segments with broad yellow bands, that on second very broad, that on fifth broadly emarginate posteriorly; sides of apex with dark fuscous hair; venter black, with a red transverse line on first segment, not extending to sides.

A remarkable species, which persistently falls with *N. (Holonomada) superba* Cresson in the tables, but is actually very different and closely related to *N. (Micronomada) arenicola* Swenk, but without coxal spines, or yellow on face or pleura. The hind tibiæ are very distinctive.

***Nomada crawfordi lachrymosa*, new variety**

WYOMING: 1 ♀ (type): Jackson, about 6300 ft. alt., along Cache Creek, among vegetation of moderately moist pasture-land type, July 15, 1920; 1 ♀, Rawlins, about 6800 ft. alt., among sagebrush on a hill near town, June 23, 1920; 1 ♀, Medicine Bow, about 6600 ft. alt., among sagebrush on the ridges having a few *Pinus scopulorum*, June 23, 1920.

♀.—Length about 11 mm.; general color of head, thorax and legs bright ferruginous, of abdomen bright yellow; eyes pale reddish gray; mandibles simple, black at end; labrum yellow; lower border of clypeus and sides of face suffusedly yellow; face broad; cheeks with pale red hair; front red; antennæ entirely bright ferruginous or darkened apically, third joint long, but shorter than fourth; mesothorax dull and densely punctured, dull red, with a black mark posteriorly; tubercles and upper border of prothorax yellow; pleura red, with a small yellow mark, not always present;

scutellum strongly bigibbous, it and the postscutellum red; metathorax with a pair of dull pale yellow spots, and often a black shade in center of basal area; tegulae orange, with a yellow spot; wings reddish, stigma bright ferruginous, nervures fuscous; basal nervure going a little basad of transverse median; anterior tibiae faintly suffused with yellow at base; hind femora with a broad black area behind; hind tibiae with an apical outwardly projecting emarginate lobe; hind basitarsi with shining golden hair on inner side; abdomen yellow with four narrow red bands, first segment red at base; venter yellow with bases of segments red, and first segment all red; second segment broadly emarginate posteriorly.

A *Xanthidium*, running in the tables near to *zebrata* and *rufula*, but quite distinct. It closely resembles *N. crawfordi* Cockerell, differing by the broad continuous yellow band on first abdominal segment, whereby it resembles *N. rhodoxantha* Cockerell. The proportions of the antennal joints are as in *crawfordi*, and after close comparisons I must regard it as a race or variety of that species, rather than an independent species. Swenk refers to a form of *crawfordi* from Nebraska, with a complete yellow band on first abdominal segment. Swenk suggests that the males which I described as *N. gillettei* and *N. ednæ* represent variations of *crawfordi*. I have no *gillettei* but, on comparing the type of *ednæ*, it seems to me to be specifically distinct, though very closely allied.

The name of this variety is in allusion to the tear-like yellowish suffusion on anterior orbits.

***Nomada concinnula*, new species**

COLORADO: 2 ♀, Electra Lake (type locality), near Durango, about 8400 ft. alt., June 29, 1919; 2 ♀, Pagosa Springs, about 7400 ft. alt., in U. S. forest reservation, San Juan valley, June 23, 1919. Both of these regions contained oaks, *Pinus scopulorum*, etc.

♀.—Length about 9 mm.; head, thorax and legs clear red, almost without yellow; sides of face suffusedly lemon-yellow; tubercles and postscutellum inclining toward orange; mandibles simple, black at end; eyes pale reddish; clypeus closely and finely punctured; antennae long, bright ferruginous, third joint considerably shorter than fourth, but more than half as long; mesothorax finely granular, entirely red; scutellum strongly bigibbous; lower part of pleura deeper, less yellowish, red than the rest; a little black about bases of coxae, and hind femora variably suffusedly blackened on inner side; tegulae yellowish red, shining but punctured; wings reddened, stigma dull ferruginous, nervures fuscous; basal nervure going a little basad of transverse median; abdomen light red with bright yellow bands, on first segment broken into two spots, on second broad at sides but thin and flexuous in middle, varying to much broader; on third, fourth and fifth broad, the last with a pair of pellucid spots; venter with first segment red, the next three with broad yellow bands the fifth with a pair of large round yellow spots, containing a small reddish spot near margin.

A pretty little *Xanthidium*, perhaps related to *rufula*. Superficially it looks exactly like *N. vallesina* Cockerell; but that has the fourth antennal joint much shorter, lacks the yellow at sides of face, etc.

***Nomada carinicauda*, new species**

COLORADO: 1 ♀, along the South Fork of the Rio Grande at about 37° 36' N., 106° 43' W., about 5800 ft. alt., among *Pinus scopulorum*, *Pseudotsuga mucronata*, *Picea pungens*, etc., June 17, 1919.

♀.—Length about 9 mm., red, similar to *N. depressicauda* Cockerell (to which it runs in the table in Entom. News, 1908, p. 323), but with the flattened caudal area much larger (describing about half a circle), with a minutely granular or tessellate bare surface, and three longitudinal keels, the keels and the margin briefly and microscopically pubescent. It also differs by the darker red of head and thorax; the longer third antennal joint (still, however, not quite so long as fourth); scutellum more strongly bigibbous. The only yellow markings on abdomen are large spots on second segment, and very small ones on third.

***Nomada vicinalis* Cresson, variety *infrarubens* Cockerell**

COLORADO: 1 ♂, Telluride, about 10,000 ft. alt., along Cornet Creek trail, July 9, 1919; 1 ♂, South Fork of Rio Grande between Pass and Hope Creeks, about 9300 ft. alt., June 18, 1919; 1 ♂, Electra Lake near Durango, about 8400 ft. alt., June 29, 1919. All of these localities are in forest regions.

These agree with Cresson's description, except that the venter is without yellow, except a suffused spot near apex. The mesothorax appears wholly black, but in the Rio Grande and Telluride specimens it is possible to see a pair of very faint red lines. The scutellum has two red spots, but no yellow. The variety *infrarubens* was described from Oregon, but the Colorado specimens cannot be separated. On the other hand, I find that *N. vicinalis aldrichi* Cockerell, from Idaho, is distinct. Compared with *aldrichi*, the present insect differs by the shorter third antennal joint and the deep emargination of the black mark on first ventral segment. I think the Idaho insect must stand as *N. aldrichi*, a separate species. It is a comparatively large form.

***Nomada illinoënsis* Robertson**

COLORADO: 1 ♀, Camp Creek Ranger Station in the Medicine Bow Range about 41° N., 106° 12' W., about 8700 ft. alt., lodgepole pine and sagebrush, June 19, 1920.

This is referred to *illinoënsis* because it appears to agree with the Nebraska form so referred by Swenk, though it has the third antennal joint considerably longer than in what I had considered to be *illinoënsis*, from Oklahoma. It appears legitimate, for the present, to interpret *illinoënsis* in a rather broad sense, recognizing that when the sexes, habits, and genitalia are known, in all probability several valid species will be segregated.

Nomada (Gnathias) orophila, new species

COLORADO: 2 ♂, 1 ♀, Camp Creek Ranger Station in the Medicine Bow Range about 41° N., 106° 12' W., about 8700 ft. alt., lodgepole pine and sagebrush, June 19, 1920.

♂ (Type).—Length about 8 mm.; head and thorax black, with coarse long white hair, slightly yellowish dorsally; face broad, orbits converging below; eyes gray; mandibles bidentate, bright yellow with dark apex; labrum, clypeus (except upper border), mark beneath eyes, and narrow lateral face-marks (ending on orbits about level of antennæ) all bright yellow; scape yellow in front; flagellum bright red, the first few joints blackened above; third antennal joint almost as long as fourth; upper border of prothorax obscurely marked with yellowish; tubercles yellow, anteriorly reddish; scutellum red, flattened, not bigibbous, densely covered with long hair; pleura with a yellow mark, bordered with reddish, in front; tegulæ shining ferruginous; wings brownish, stigma ferruginous, nervures fuscous; basal nervure going far basad of transverse median; legs red, anterior knees yellowish, hind femora black behind and beneath, except at apex; abdomen bright red, with narrow black bands, which are in the main on the extreme bases of the segments; very large spots on second segment, smaller ones on third, but no other yellow markings; first dorsal segment black basally, and first ventral black in middle.

♀.—Length about 8 mm.; head and thorax rather dusky red, abdomen bright chestnut red, polished; hair of top of head and scutellum strongly reddish; face red with no yellowish tint; middle of front and region of ocelli black, and a black band passes downward from each antenna, invading sides of clypeus; eyes gray; antennæ entirely bright red, third joint perhaps a little longer than fourth; mesothorax red with a broad median black band, and narrow lateral ones, failing posteriorly; metathorax red at sides of middle but broadly black in middle and extreme sides; cheeks black with a red postorbital band; legs bright red, the femora with a black spot at base beneath; abdomen with spots on second segment round and rather small, on third nearly obsolete; first ventral with a large bifid black mark, the lobes of which are very broad and obtuse.

In *Gnathias*, the Rocky Mountain males usually differ from those of the Eastern and Northwestern States in the more or less red mesothorax; but *N. orophila*, from high in the mountains, has it black. The male *orophila* falls near *N. cuneata* Robertson, but is much more robust in every way. The female also falls next to *cuneata*, but has less yellow on the abdomen.

Nomada bella Cresson

IDAHO: 1 ♀, Victor, about 6300 ft. alt., July 11, 1920; 1 ♀, Giveout, near Montpelier, about 6700 ft. alt., July 7, 1920. COLORADO: 1 ♀ (a variation with basal area of metathorax black), along the South Fork of the Rio Grande at about 37° 36' N., 106° 43' W., about 8500 ft. alt.

Specimens from Costilla County, Colorado, which Swenk in 1912 placed under *bella*, were transferred by him to *schwarzi* in 1915. The type of *schwarzi* is a male from Veta Pass. The female described by me

under *schwarzi* was *lepida*. At present, I probably have the ♀ of *schwarzi* mixed with Rocky Mountain *bella* and do not know how to separate it.

***Nomada carolinæ* Cockerell**

COLORADO: 2 ♀, Julesburg, at *Salix* flowers along the river, about 3460 ft. alt., June 7, 1920.

Compared with a Nebraska specimen, one of these differs by lacking the black band down middle of metathorax, and the somewhat longer third antennal joint. On comparing specimens from Virginia and Texas, I find enough variation to include the Julesburg insect, unless *carolinæ* as at present accepted should prove capable of subdivision. The other specimen with exactly the same data has the metathoracic band well developed, and in general agrees well with the Nebraska specimen.

***Nomada perplexa* Cresson**

WYOMING: 1 ♀, Jackson, about 6300 ft. alt., among vegetation of moderately moist pasture-land type, July 14, 1920.

The form without yellow spots on abdomen. *N. perplexa* is common in the Northern Atlantic States (Pennsylvania, for example), but I did not expect to see it from Wyoming.

***Nomada siouxensis* Swenk**

WYOMING: 1 ♀, Jackson, about 6600 ft. alt., among blue spruce, aspen, and other mesophytic plants along Cache Creek, July 15, 1920.

Differs from the original description in having small and inconspicuous orange spots at sides of second abdominal segment, but evidently this species. It was described from Sioux County, Nebraska.

***Nomada* (*Gnathias*) *heterosticta*, new species**

IDAHO: 1 ♀, Victor, about 6300 ft. alt., among aspens, roses, etc., on the hills across the river from the town, July 11, 1920.

♀.—Length about or nearly 10 mm.; bright ferruginous red, not dark; mandibles bidentate, black at end; a dusky shade between antennæ, region between (but not around) ocelli blackened, and cheeks black behind, leaving a red band as broad as the black; eyes pale red; antennæ entirely clear ferruginous, third joint about as long as fourth; mesothorax with a narrow median black band; femora without black, except that the hind femora have a dusky stripe beneath, not conspicuous; tegulæ dull pale reddish, strongly punctured; wings dilute reddish fuliginous, stigma ferruginous, nervures dark fuscous; basal nervure going far basad of transverse median, third submarginal cell unusually broad above; abdomen clear red, without black marks at base above or below; sides of second segment with small yellow spots, but on third, in place of yellow marks, are dusky dots.

In my table this runs nearest to *N. grayi* Cockerell, but it differs in a number of characters and is especially recognizable by the markings of the abdomen.

***Nomada (Gnathias) clarescens*, new species**

COLORADO: 1 ♀, Walden, about 8300 ft., on the sagebrush hills near town, June 17, 1920.

♀.—Length nearly 10 mm.; clear red, the antennæ entirely red, the flagellum with a fine pruinose pubescence; eyes red; mandibles bidentate, black at end; a blackish W-like mark about bases of antennæ, and the region between ocelli blackened; cheeks black behind, leaving a very broad red band; third antennal joint about as long as fourth; mesothorax with a narrow black band; middle of metathorax with an elongate black spot; pleura with abundant long pale hair (short scanty hair in *N. heterosticta*); scutellum strongly bigibbous (so also in *heterosticta*); tegulæ ferruginous, rather shining; wings dusky with the usual hyaline space; stigma dusky reddish (smaller and narrower than in *heterosticta*); basal nervure going far basad of transverse median, third submarginal cell greatly narrowed above; femora marked with black beneath at base; inner face of hind basitarsi with very pale hair; first abdominal segment with a round black spot on each side near base; second with small yellow spots, the rest without yellow; first ventral with a blackish shade, but no well-defined mark.

The first ventral segment and other characters readily distinguish it from *N. grayi*.

***Nomada (Gnathias) vulpis*, new species**

WYOMING: 1 ♀, Foxpark, about 9100 ft. alt., in the Medicine Bow Range, lodgepole pine, and sagebrush, June 15, 1920 (snow still lying in patches nearby).

♀.—Length nearly 10 mm.; red, with the aspect of *N. clarescens*, but a little less robust. It is certainly distinct, by the following characters: black about antennæ and ocelli much more extensive, and continuing as sutural lines half-way down sides of clypeus; flagellum more slender, and dusky above, toward base strongly blackened; median band of mesothorax broader, and a broad median black band down middle of metathorax, including basal area; extreme sides of metathorax broadly black; red band along posterior orbits much narrower; second submarginal cell not so broad, receiving first recurrent nervure about beginning of last third; second abdominal segment with large clear-cut yellow marks; third wholly without spots; first ventral with a black fish-tail mark.

Allied to *N. bella*, but I think certainly not a variety of it. Compared with a specimen of *N. maculata* Cresson (♀ of *bella*) from Franklinville, Pa., it is considerably less robust, with smaller head, much more black on face, cheeks mainly black (in the *maculata* red, with a black patch posteriorly, covered with hair and inconspicuous), yellow on abdomen reduced to a pair of spots, surface of abdomen less shining, etc. It evidently approaches Swenk's interpretation of female *N. schwarzi* Cockerell, but the probabilities are against its reference to that species.

Nomada packardiella Cockerell

COLORADO: 1 ♀, Ouray, about 8500 ft. alt., among oak and *Pseudotsuga*, July 12, 1919; 1 ♀, Tennessee Pass, about 10,500 ft. alt., August 7, 1920; 1 ♀, Leadville, about 10,300 ft. alt., August 3, 1919, collected by Pearce Bailey, Jr.

The type of *packardiella*, from Boulder, has the fourth and fifth abdominal segments each with a pair of yellow spots. The Ouray specimen has the spots faintly indicated on the fifth segment, but in those from above 10,000 ft. they have entirely disappeared, though the lateral spots on second and third segments remain. Contrary to expectation, the antennæ of these high-altitude forms are of a clearer red than those of the type.

The above species of *Nomada* may be separated by the following table.

Scutellum yellow or with yellow markings.....	1.
Scutellum without yellow.....	14.
1. Mesothorax red, with a median black band or mark.....	2.
Mesothorax black, usually red or yellow on lateral margins.....	6.
2. Scape swollen, largely yellow; face lemon-yellow.....	3.
Scape not swollen.....	4.
3. Pleura behind tubercles yellow; fourth antennal joint long.	
<i>calloxantha</i> Cockerell, ♀.	
Pleura behind tubercles red, with at most a yellow line; fourth antennal joint much shorter.....	
<i>vineta heterochroa</i> Cockerell, ♂.	
4. Sides of face with broad cream-colored stripes; a very dark cloud in apical field of anterior wings.....	
<i>gutierreziae</i> Cockerell, ♀.	
Sides of face not so marked.....	5.
5. Smaller; supraclypeal region black with a quadrate or subtriangular red area.	
<i>morrisoni</i> Cresson, ♀.	
Larger; supraclypeal region red.....	
<i>zebrata</i> Cresson, ♀.	
6. Clypeus shining black; small species.....	
<i>crucis</i> Cockerell, ♀.	
Clypeus black, with lower margin and corners red.....	
<i>melanoptera</i> Cockerell, ♀.	
Clypeus red; facial quadrangle longer than broad.....	
<i>vineta</i> Say, ♀.	
Clypeus yellow.....	7.
7. Region below antennæ black, the black ending in a point next to clypeal margin; scutellum black with two yellow spots; males.....	8.
No such black areas ending in a point at sides of clypeus.....	9.
8. Larger; legs mainly yellow.....	
<i>civilis</i> Cresson.	
Smaller; legs red and black.....	
<i>cymbalariae</i> Cockerell, var.	
9. Smaller; face pale yellow or cream-color; a conspicuous apical dark cloud on wings.....	
<i>crucis</i> Cockerell, ♂.	
Larger; face bright lemon-yellow.....	10.
10. Anterior corners of mesothorax yellow.....	11.
Anterior corners of mesothorax red or black.....	13.

11. Lateral face-marks following anterior orbits (which are parallel) to top of eyes; scape swollen..... *zebrata* Cresson, ♂.
Lateral face-marks not following orbits to top of eyes..... 12.
12. Larger; face broader; orbits conspicuously diverging above; lateral face-marks not curved mesad at upper end..... *edwardsii* Cresson, ♀.
Smaller; face not so broad; orbits nearly parallel; lateral face-marks curved mesad at upper end..... *citrina* Cresson, ♀.
13. Area of metathorax with a short yellow band on each side; third antennal joint long..... *pecosensis* Cockerell, ♀.
Area of metathorax all black..... *vincta* Say, ♂.
14. Mesothorax black (often with a pair of very narrow and obscure red lines in *vicinalis infrarubens*); scutellum red or marked with red..... 15.
Mesothorax red, or red and black..... 17.
15. Lateral face-marks curving away from orbit at top; mandibles simple.
vicinalis infrarubens Cockerell, ♂.
Lateral face-marks not curving away from orbit..... 16.
16. Mandibles simple; basal nervure going very little basad of transverse median.
illinoënsis Robertson, ♂.
Mandibles bidentate; basal nervure going far basad of transverse median.
orophila Cockerell, ♂.
17. Abdomen with cream-colored bands, continuous on fourth and fifth segments; clypeus red..... *accepta* Cresson, ♀.
Abdomen with continuous lemon-colored bands, at least on one of the first three segments..... 18.
Abdomen without such bands; clypeus not yellow..... 21.
18. First abdominal segment with a broad continuous yellow band.
caufordii lachrymosa Cockerell.
First abdominal segment without such a band..... 19.
19. Mesothorax black with four red bands; front black except sides broadly, and a spot below middle ocellus; tubercles and postscutellum yellow.
alpha paralpha Cockerell, ♀.
Mesothorax red..... 20.
20. Larger; region of ocelli broadly black..... *alpha dialpha* Cockerell, ♀.
Smaller; region of ocelli red, with at most a little black.
concinnula Cockerell, ♀.
21. A transverse black patch above or between antennæ..... 22.
No black patch above or between antennæ; mandibles bidentate.
carolinæ Cockerell.
22. Abdomen with narrow black bands; mandibles simple.
packardiella Cockerell, ♀.
Abdomen without distinct black bands, or only on one or two segments... 23.
23. A small black spot at each side of third segment near base; no black spots on fourth segment; mandibles bidentate..... *heterosticta* Cockerell, ♀.
No such black spots on third segment..... 24.
24. Abdomen with a large highly modified caudal area, with three keels.
carinicauda Cockerell, ♀.
Abdomen without such an area; mandibles bidentate..... 25.

***Calliopsis coloradensis fedorensis* (Cockerell)**

The female has the disc of first abdominal segment beset with fine punctures, but I cannot find good characters for the male. One female (Boulder, COLORADO, on the plains at about 5300 ft. alt., August 12, 1919) had the clypeus black except the lower corners and a T-shaped mark. It is only a variant, as three typical *fedorensis* females were taken at Boulder, with the same data. One female from Salt Lake City, UTAH, at about 5000 ft. alt., July 28, 1920, collected by Mrs. F. E. Lutz, can be referred here, but the punctures on the first segment are much coarser, and it is presumably an independent mutation from *coloradensis*.

Professor O. A. Stevens has taken *fedorensis* at flowers of *Grindelia squarrosa*, at Fargo, North Dakota. He obtained, with normal females, a variant in which the clypeus is entirely black, except a slender line across its upper border.

Calliopsis chlorops Cockerell, 1899, is not to be separated from *coloradensis*. The male differs from Cresson's description in having the tibiae brown or piceous posteriorly, but this is not even a good racial character.

C. coloratipes (Cockerell) is at least a good subspecies; the male has the face creamy white or very pale yellowish, instead of lemon-yellow, and the female lacks the black bars on clypeus. *C. coloratipes* occurs in New Mexico and Arizona, in the Middle and Lower Sonoran Zones.

***Calliopsis rhodophilus* (Cockerell)**

This is the western representative of *C. andreniformis* Smith. Two males from Ouray, about 8500 ft. alt., July 11, 1919, and three males from Pagosa Springs, about 7400 ft. alt., June 23, 1919, are typical. One female from Estes Park, August 13, 1919, collected by Herbert F. Schwarz, is a variation with face-marks reduced, the lateral marks reduced to small spots. It thus approaches *C. teucarii* Cockerell, which may be an extreme form of *rhodophilus*; but the mandibles are entirely dark, not bright ferruginous in middle as in *teucarii*. The abdominal venter lacks the light reddish bands seen in *teucarii*. The localities just mentioned are in COLORADO.

***Calliopsis verbenæ nebrascensis* Crawford**

COLORADO: 1 ♂, Wray, about 3700 ft. alt., dry hills near town, August 17, 1919.

HYPOMACROTERA Cockerell and Porter**Hypomacrotera callops** Cockerell and Porter

COLORADO: 5 ♂, Regnier, near the state border south of Lamar, about 4400 ft. alt., at *Quincula lobata*, June 8, 1919.

PSEUDOPANURGUS Cockerell**Pseudopanurgus æthiops** (Cresson)

COLORADO: 8 ♀, 5 ♂, Wray, about 3700 ft. alt., some at *Helianthus*, August 18, 1919; 3 ♀, 10 ♂, La Junta, about 4100 ft. alt., August 12, 1920. UTAH: 5 ♀, 5 ♂, Ogden, August 29-30, 1916.

One male is stylopidised, and differs from normal males in having the clypeus broadly black at sides, the supraclypeal yellow broader than high, the dog-ear marks much shorter, the lateral face-marks and yellow marks on scape wholly wanting. Also, the anterior and middle tibiæ have the apical half black, and the sculpture of the abdomen is weaker. The stylopid is undescribed.

BOMBOMELECTA Patton**Bombomelecta fulvida** (Cresson)

COLORADO: 1 ♀, South Fork (near the headwaters of the Rio Grande), about 8200 ft. alt., near the town, June 17, 1919. ARIZONA: 1 ♀, Grand Canyon, May 24, 1918.

Bombomelecta pacifica (Cresson)

COLORADO: 1 ♂, Cheyenne Pass, near Laramie, about 8500 ft. alt., limber pine-Douglas fir country, June 13, 1920; 1 ♂, Julesburg, about 3460 ft. alt., near the river, at *Pentstemon radicosus*, June 7, 1920.

PSEUDOMELECTA Radoszkowski**Pseudomelecta rociadensis** (Cockerell)

COLORADO: 1 ♀, Gardner, September 1918, collected by Walter Granger (?); 1 ♀, Wray, about 3700 ft. alt., at head of Dry Willow Creek, August 18, 1919. Both specimens much worn.

Pseudomelecta miranda (Fox)

COLORADO: 1 ♂, La Junta, about 3100 ft. alt., along the roadside, August 12, 1920, collected by Mrs. F. E. Lutz.

59.82 (728)

DESCRIPTIONS OF PROPOSED NEW BIRDS FROM CENTRAL AMERICA, WITH NOTES ON OTHER LITTLE-KNOWN FORMS

BY WALDRON DEWITT MILLER AND LUDLOW GRISCOM

As a result of studies made on the distribution of bird-life in Nicaragua, the authors here propose definite names for a number of birds, to invite criticism pending the appearance of their final report.

There is also included a discussion of the status of other little-known Central American birds, belonging to families that will be treated by Mr. Ridgway in the forthcoming part of his monumental work on the Birds of North and Middle America. We have to thank the authorities of the National Museum, and particularly Dr. Charles W. Richmond, for permission to examine material in their collection bearing on one of these cases.

Ortalis cinereiceps saturatus, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Ortalis c. cinereiceps* but darker throughout and averaging smaller. Crown and nape very slightly darker, deep mouse-gray instead of deep neutral gray; the back, wing-coverts, and rump deep olive-brown, instead of medium olive-brown, the contrast greatest on the wing-coverts; primaries dark rufous rather than bright rufous, the dusky tips and centers of the feathers more extensive and noticeable; tail tips grayish buffy rather than gray with whitish margins, the tips of the three outer feathers averaging 2 mm. less in extent; breast darker olive-gray, shading into light buffy olive-gray on the belly instead of almost pure light gray, the contrast best seen on the thighs; under tail-coverts olive-brown, rather than grayish olive. In each series some specimens are much browner on the breast than others.

TYPE.—No. 101063, Amer. Mus. Nat. Hist.; ♂ ad.; near Matagalpa, Nicaragua; March 4, 1907; Wm. B. Richardson.

SPECIMENS EXAMINED

Ortalis cinereiceps saturatus.—NICARAGUA: Matagalpa, the type; Las Canas, Matagalpa, 1 ♂; Savala, 1 ♂; Muy Muy, 1 ♂; Rio Grande, 1 ♀; Chontales, 1 ♀; Los Sabalos, 1 ♂. COSTA RICA: Bonilla, 1 ♂; Aquinares, 2 ♂.

Ortalis cinereiceps cinereiceps.—PANAMA: Boqueron, Chiriqui, 1 ♂, 1 ♀; Canal Zone, 1 ♂, 1 ♀; Chepigana, East Panama, 1 ♂.

This form is based on 10 specimens from the humid tropical Atlantic forest region of Nicaragua and Costa Rica, and is compared with a series of what may be regarded as typical material from Panama. We have seen

no specimens from southern Costa Rica, but it would be surprising if the bird there did not approach the new form. There are slight differences in size, although the measurements of the two races show a considerable amount of individual variation.

MEASUREMENTS

	<i>O. c. cinereiceps</i>			<i>O. c. saturatus</i>	
Wing	3 ♂	196-216	8 ♂	187-204	
	2 ♀	193	2 ♀	187-192	
Tail	3 ♂	220-232	8 ♂	204-220	
	2 ♀	219-222	2 ♀	197	
Culmen	3 ♂	24-27	8 ♂	24-26	
	2 ♀	23.5-25.5	2 ♀	22-23	
Tarsus	3 ♂	65-68	8 ♂	65-67	
	2 ♀	65-70	2 ♀	61-62	

***Creciscus ruberrimus*, new species**

SPECIFIC CHARACTERS.—Closely allied to *C. ruber* of Mexico and Guatemala, but differing in having the chestnut of the upper back extended over the entire upper-parts including the wing-coverts; the back, rump, upper tail-coverts, and wing-coverts rich deep chestnut instead of chocolate-brown; primaries and tail blackish instead of ashy brown; bill shorter and relatively stouter.

TYPE.—No. 143692, Amer. Mus. Nat. Hist.; ♀ ad.; Jinotega, Nicaragua (alt. about 3000 ft.); April 5, 1917; Miller and Griscom.

DESCRIPTION OF TYPE.—General color above rich deep chestnut, darkest on the rump; primaries and tail-feathers blackish, the secondaries deep blackish brown; crown, nape, and sides of face bright slaty gray, sharply demarcated from the chestnut color of the adjacent parts; throat and breast bright chestnut, becoming rich deep chestnut on the abdomen, belly, and under tail-coverts; thighs externally deep slaty gray, internally bright chestnut; under wing-coverts and axillars bright chestnut, the greater series ashy, edged with chestnut.

SPECIMENS EXAMINED

Creciscus ruberrimus.—NICARAGUA: Jinotega, the type.

Creciscus ruber.—MEXICO, 1; GUATEMALA, 1.

MEASUREMENTS

	Nicaragua	Guatemala	Mexico
Wing	79	78	78.5
Tail	36	—	39
Culmen	18	21	21
Depth of Bill at Base	7.5	7.5	7.5
Tarsus	31	34.5	34
Middle Toe and Claw	37.5	39	40

This beautiful little Rail was collected in a surprisingly arid habitat, which is separated from that of *C. ruber*, its close ally, by a wide stretch of such mountainous and broken country that intergradation does not seem at all likely.

For the present we prefer to retain the old generic name, especially as Mr. Ridgway, the describer of *Thryocrex*, has not seen several important species. Until the exact limits of *Porzana* and *Creciscus* are determined by a critical examination of all the species involved throughout the world, there seems little point in proposing segregates from either. Our treatment must not, however, be taken as our opinion of the proper generic relationships of the two species here discussed, our material of this group of Rails being entirely inadequate.

***Gallinula chloropus centralis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *G. c. cachinnans*, but decidedly darker and slightly smaller, the gray of the upper back and breast slightly darker, lower back much darker, "mummy brown," instead of "argus brown" or "Brussels brown," becoming blackish brown on the rump and upper tail-coverts.

TYPE.—No. 143693, Amer. Mus. Nat. Hist.; ad. ♀; 12 miles south of Metapa, Central Nicaragua; April 25, 1917; Ludlow Griscom.

SPECIMENS EXAMINED

Gallinula chloropus centralis.—NICARAGUA: Metapa, the type; Tipitapa, 1 ♀.

Gallinula chloropus cachinnans.—EASTERN UNITED STATES, 21 ♂, 20 ♀.

MEASUREMENTS

	Wing	Culmen to Hind Edge of Frontal Shield	Tarsus
Nicaragua 2 ♀	163.5-168 (165.7)	45-46 (45.5)	50-51 (50.5)
Eastern U. S. 20 ♀	164-176 (170.2)	40-47 (44)	50-57 (54.1)

The two adult females listed above are so distinct from a large series of *cachinnans* that we have no hesitation in describing them. Birds seen at Los Sabalos by Nutting and specimens taken by Holland at Greytown probably belong to this race, but we are unable at this time to state its range more accurately. It is interesting to note that the proposed new race is not in any sense intermediate between *cachinnans* and *pauzilla* from western Colombia. The latter is by far the smallest, but is lighter on the back than even *cachinnans*. There seem to be but single records of the Florida Gallinule from Costa Rica and Panama. It would be interesting to determine accurately the specimens on which they are based.

We follow the latest authorities on the genus, Bangs and Hartert, in treating the American Gallinules as races of the Old World *chloropus*, but we are not convinced that this is the best course. While our material is not entirely satisfactory for a revision of the genus, we are strongly of the opinion that *sandvicensis* and *garmani* are distinct species, and that *cerceris* is a valid race.

***Asturina plagiata micrus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *A. p. plagiata*, but much smaller, the adults averaging slightly darker, with narrower tail-bands, the immature birds noticeably darker.

TYPE.—No. 143746, Amer. Mus. Nat. Hist.; ad. ♂; 4 miles northeast of Chinandega, Nicaragua; June 12, 1917.

SPECIMENS EXAMINED

Asturina plagiata micrus.—NICARAGUA, adults, 4♂, 4♀; immature, 2♂, 1♀. COSTA RICA: Pigres, 1♀ ad.

Asturina plagiata plagiata.—ARIZONA, 1♂ ad.; TEXAS, 1♀ imm.; MEXICO, adults, 15♂, 10♀; immature, 13♂, 4♀.

MEASUREMENTS

	Wing	Tail	Culmen	Tarsus
<i>A. p. plagiata</i> 16 ♂	261-282 (269.4)	[190]-213 (202)	30-35 (31.9)	71-78 (74)
<i>A. p. micrus</i> 6 ♂	241-257 (250.5)	192-212 (201.2)	29-31 (30.3)	67-73 (69.8)
<i>A. p. plagiata</i> 10 ♀	287-300 (292.6)	[205]-233 (216.3)	33-35 (34.5)	74-88 (78.4)
<i>A. p. micrus</i> 5 ♀	256-282 (270.2)	180-214 (205.6)	30-34 (31.8)	69-79 (74.8)

The small size of this new form is its chief diagnostic character, even in a group of birds where there is so much individual variation, the wing measurements not even overlapping. The differences in color are slight, as the darkest birds of *A. p. plagiata* are indistinguishable from the lightest of *A. p. micrus*. The majority, however, of our specimens of the new form, both adult and immature, are darker than any in a very large series of the northern bird. The adults have the gray of a darker tone throughout, most noticeable in the cross-barring below. The immature have the upperparts and the tear-shaped spots beneath of a decidedly blackish brown. In typical adult *A. p. plagiata* from eastern Mexico there are usually two well-defined tail-bars, and in the majority of specimens traces of a third, while the middle bar is complete. In only one specimen is both the third tail-bar lacking and the middle one incomplete. Birds from Sinaloa and Sonora never have a trace of a third bar, the middle bar is complete in one specimen only, and in others is reduced to a mere spot.

We have two birds from Tepic, however, which show traces of a third bar, so that it is impossible to separate western and eastern Mexican birds subspecifically as we have found no other differences. The Nicaraguan bird is the extreme of the western Mexican tendency. The middle or second bar is always reduced to a spot, which in some specimens is scarcely discernible. In addition, the subterminal bar, which is always complete, averages narrower than in the northern bird.

We have seen no material in the territory between southern Mexico and Nicaragua, so cannot say where the boundary line between the two races is.

In Nicaragua this Hawk is a common bird of the Pacific slope and specimens exist from practically every locality where collecting has been done. There are no records for the Atlantic forest section. It is not at all shy, which probably accounts in part for the numerous specimens.

***Ictinia plumbea vagans*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar in color to *I. p. plumbea*, but averaging larger, the wing, ♂ 300–319; ♀ 292–316, the measurements of the two races not overlapping.

TYPE.—No. 103676, Amer. Mus. Nat. Hist.; ♂ ad.; Peña Blanca, Nicaragua; June 6, 1909; Wm. B. Richardson.

SPECIMENS EXAMINED

Ictinia plumbea vagans.—MEXICO, 1 ♀; GUATEMALA, 1 ♂, 1 ♀; HONDURAS, 1 ♂, 1 ♀; NICARAGUA, 4 ♂, 3 ♀; PANAMA, 1 ♂, 1 ♀; COLOMBIA, 1 ♀; ECUADOR, 5 ♂; PERU, 3 ♀; BRAZIL, Matto Grosso, 2 ♂, 6 ♀.

Ictinia plumbea plumbea.—COLOMBIA, 3 ♂, 1 ♀; ECUADOR, 1 ♀; TRINIDAD, 1 ♂; VENEZUELA, 1 ♀?; BRAZIL, Bahia, 1 ♀, Matto Grosso, 8 ♂, 2 ♀.

MEASUREMENTS

Ictinia plumbea plumbea

		Wing	Tail	Tarsus		Wing	Tail	Tarsus
Colombia	♂ (Jan.)	270	148	40	♀ (March)	284	102	41
	♂ (March)	295	165	41.5				
	♂ (May)	279	146	40				
Ecuador					♀ (April)	274	150	42
Trinidad	♂ (March)	288	150	42.5				
Venezuela					♀ ? (late March)	267	146.5	41
Bahia					♀ (late March)	277	145	44.5
Matto Grosso	♂ (Aug.)	297	156	43.	♀ (Sept.)	285	161	42
	♂ (Sept.)	292	152	40	♀ (Oct.)	272	150	42
	♂ (Sept.)	293	153	41				
	♂ (Sept.)	278	152	41.6				
	♂ (Oct.)	286	145	40				
	♂ (Oct.)	291	149	41				
	♂ (Nov.)	288	153.5	40				
	♂ (Dec.)	288	162.	39.5				

Ictinia plumbea vagans

Mexico					♀ (April?)	297	157	45
Guatemala	♂	311			♀	298		
Honduras	♂	313	161	42.5	♀	305	158.5	43
Nicaragua	♂	301	165	40	♀	296	158	44
	♂	307	—	40	♀	301	159.5	43
	♂	309	157.5	40	♀	311	167	41
	♂	311	159	42				
Panama	♂ (?)	307	156	42	♀ (?)	306	162	42
Colombia					♀ (June)	304	169	41
Ecuador	♂ (Oct.)	301	150	43.7				
	♂ (Dec.)	300	(150)	42				
	♂ (Dec.)	305	153	41				
	♂ (Dec.)	308	157.5	42				
	♂ (Jan.)	310	150	43.5				
Peru					♀ (Nov.)	311	168.5	38.5
					♀ (Nov.)	316	170.5	42
					♀ (Dec.)	299	169	40
					♀ (Sept.)	298	164	40.5
					♀ (Oct.)	292	164	40.5
Matto Grosso	♀ (Aug.)	321	167	44	♀ (Oct.)	292	161	37.5
	♂ (Dec.)	307	159	41.5	♀ (Nov.30)	294	156	41
					♀ (Dec.)	296	164	41.5
					♀ (Jan.)	302	156	40.5

SUMMARY

		Wing	Tail	Tarsus
<i>I. p. plumbea</i>	12 ♂	270-297 (287.1)	145-165 (152.6)	39.5-43 (40.7)
<i>I. p. vagans</i>	14 ♂	300-321 (307.1)	150-167 (157.3)	40-44 (41.9)
<i>I. p. plumbea</i>	6 ♀	267-285 (276.5)	145-162 (154.1)	41-44.5 (42.1)
<i>I. p. vagans</i>	17 ♀	292-316 (301.1)	156-170.5 (162.7)	37.5-45 (41.3)

The recognition of this new race is apparently justified. In most of Central America it has been recorded only as a migrant in March, April, May, and November, but Salvin and Godman found it nest-building in Guatemala, and Richardson sent them birds from eastern Mexico in June and July. He has also sent us a bird from Peña Blanca, Nicaragua, taken in June, which may have been breeding. The species has never been recorded from Costa Rica. Salvin and Godman state that they have a nestling from Panama, so the species certainly breeds there, though what race we cannot say. The presence of *vagans* in Santa Marta in June may indicate its breeding there. In Matto Grosso, Brazil, both birds obviously occur together. Fortunately, our series is sufficiently large to pick out representatives of the two races with a reasonable degree of certainty. The same may be said for Ecuador, the birds taken in October, December, and January being obviously large, and April birds obviously small. The Bahia bird again, taken in March, is immature, indicating that it was probably hatched out a few months earlier in the vicinity. If the entire absence of the species from Costa Rica may be taken as an index, *I. p. vagans* breeds north of that country only, but perhaps it breeds in Panama and Santa Marta. That it has not been recorded from Costa Rica at all is surprising when we consider that the bird is common, migrates in flocks, and is not particularly shy.

THE STATUS OF *Crax panamensis* OGILVIE-GRANT

This species was described in the Catalogue of Birds, XXII, p. 479, with a habitat from southern Nicaragua to Colombia and was based on six specimens. The adult male differs from *C. globicera* in having a slight white tip to the tail. The adult female is said to differ from *globicera* in having the tail strongly barred with white both above and below; no white markings on the wing; back of neck, mantle, and chest rufous-chestnut almost devoid of black. So-called "younger" females of both species are more or less barred or freckled with black throughout.

In attempting to identify our Nicaraguan material, we soon found that matters were not as simple as they appeared. *C. globicera* had been recorded from Nicaragua by Nutting and Richmond, but these records had been placed under *panamensis* by Salvin and Godman in the *Biologia Centrali-Americana*. Incidentally, Carriker gives *C. panamensis* from Costa Rica, on the ground that all birds have the tail strongly barred, a far from convincing reason, as "immature" female *globicera* has the tail barred according to Grant.

Turning now to our specimens, an adult male from Nicaragua and no less than three out of four males from Panama prove to be undoubted *globicera*, which is not supposed to range south of Honduras! Of four "adult" females from Mexico, one has no white freckling on the wings, thus supposedly approaching *panamensis*. Four "adult" females from Panama and Colombia correspond quite well to Grant's description of *panamensis*, but one has black barring across the back, and the tail-bars are a different color in each, varying from ochre to yellowish white. We might add that these tail-bars average about 12 mm. in width. Three "immature" females from Nicaragua do not, however, correspond to anything in Grant's descriptions. Two are exactly like "adult" female *globicera* above in being black rather than rufous-chestnut, but a third is intermediate in this character. This latter bird has tail-bars just like our Panama females, but the other two have much whiter and narrower tail-bars averaging 3-4 mm. wide. Finally, these two birds have barred chests and thighs, while the third has none, and we might add that the tail-bars of all three are just as clearly marked on the under surface of the feathers as the upper. It becomes obvious that these three birds represent two plumages which completely connect the alleged differences between the females of the two species. Further, there is no evidence that these various changes in plumage and age are correctly correlated. For birds which vary so remarkably as do these Curassows, a far larger series and study in the field would be required before the age of a specimen can be told by its plumage.

Finally, we had the privilege of examining an excellent series of Mexican *C. globicera* in the U. S. National Museum, thanks to the courtesy of Dr. Charles W. Richmond. Every one of the supposed characters of female *panamensis*, in all ages or stages of Grant's, can be found in this series. We have no hesitation in saying that at present there is not a single reliable character on which to separate these supposed species, and *Crax panamensis* should accordingly become a synonym of *Crax globicera*.

Aramides cajanea AND ITS ALLIES IN CENTRAL AMERICA

In 1907 Outram Bangs published an excellent revision of the Wood Rails of Central America.¹ In this paper he eliminated *chiricote* as a subspecies of *A. cajanea*, considered *plumbeicollis* a race of *albiventris*, and described another race from eastern Mexico. We do not feel able to follow his treatment of *plumbeicollis*, which seems to us strikingly distinct from *albiventris*. We have had a much larger series of this form available and are able to extend its range northward to the Roman River, Honduras, which is just east of Trujillo. This series is absolutely constant, and the Honduras birds do not show the slightest elements of an approach to *albiventris*.

Our series shows that several of Mr. Bangs' characters do not hold. The type of *A. albiventris*, for instance, has an olive-tawny mantle, and consequently is not unicolor on the back, so that this character, which he relies upon in his key to distinguish *plumbeicollis*, is apparently not absolute. We do find, however, that there is a difference between them which has not been brought out. The bills of specimens of *albiventris* from both Guatemala and British Honduras are orange-yellow for the basal two-thirds, the terminal third of the upper mandible being orange-yellow and the lower mandible green. In *mexicanus*, *plumbeicollis*, and the other related species *cajanya*, the whole terminal third of the bill is pale apple-green.

Again, Mr. Bangs separates *cajanya* from *albiventris* and its races in that the back of the head is grayish brown instead of bright chestnut, and the shorter, stouter bill. Here we desire to point out that our excellent series of *plumbeicollis* is intermediate not only in the length of the bill, but in the color of the head, which could not possibly be called chestnut. In fact, in these two characters *plumbeicollis* is much nearer *cajanya* than *albiventris*, a situation which is further emphasized by the color of the abdomen. Below we give a tabular arrangement of the diagnostic characters of the four forms which, we hope, will outline the problem as graphically as possible.

¹Amer. Naturalist, XLI, pp. 177-187.

<i>A. albiventris</i>	<i>A. plumbeicollis</i>	<i>A. cajanea</i>	<i>A. mexicanus</i>
1. Bright chestnut crown patch	Bright brown	Dull to bright grayish brown	Bright brown
2. Broad patch of white feathers on abdomen	Narrow patch of buffy feathers	Breast and abdomen uniform chestnut	Narrow patch buffy feathers
3. Generally pale coloration	Dark coloration	Dark coloration	Dark coloration
4. Bill 60-66	Bill 53-61	Bill 50-57	Bill 61-73
5. Terminal third of upper mandible orange-yellow	Light apple-green	Light apple-green	Light apple-green
6. Back usually (?) concolor	Back never concolor	Back concolor	Always concolor, or nearly so
7. Iris yellow	Iris orange-red	Iris orange-red	Iris ?

In addition to these characters, it should be pointed out that, while the bill *length* is a gradual progression from south to north, *cajanea* is proportionately stouter. In the crown character *plumbeicollis* is much nearer *cajanea* than *albiventris*, while *mexicanus* is slightly nearer *albiventris*.

It seems to us on this showing that Mr. Bangs' treatment, in which he makes *plumbeicollis* and *mexicanus* races of *albiventris*, becomes untenable. *A. albiventris* stands out sharply as a very distinct species. The only ground for considering *plumbeicollis* a race of *albiventris* is its close affinity to *mexicanus*, which is stated to intergrade with *albiventris*. This alleged intergradation, however, is based on two specimens which Mr. Bangs calls intermediate, but they come from localities which are not strictly intermediate in the ranges of the two forms, one of them in fact from western Guatemala and the other from central Guatemala, hardly satisfactory proof of subspecific intergradation in the strict sense of the word. Even if this point were waived, the subspecific claims of *plumbeicollis* rest on nothing but a *priori* reasoning, and a second glance at our table of characters shows that, if it is to be a race of anything, its affinities are with *cajanea* rather than *albiventris*.

This view of the case is strengthened by our discovery of a Pacific race of *plumbeicollis* in Nicaragua, to be described below, which differs in being slightly darker, and especially in having lost all traces of light, buffy feathers on the abdomen. This is a step further from *albiventris*, and a *priori* reasoning to make this bird a race of *albiventris*, with which it has not a single diagnostic character in common, is strained to the breaking

point. *A. plumbeicollis* must be regarded, to our way of thinking, as a distinct species in default of any proof of intergradation with either *albiventris* to the north or *cajanea* to the south.

Further, we think that *mexicanus* must be accorded specific rank until complete intergradation with *albiventris* is established.

Finally, let us bear in mind that these Wood Rails are unquestionably an invasion from South America. The parent stock was originally one species which broke up into four races, as we go northward. Special isolation factors have evolved *albiventris* as the most distinct type. The other species are admittedly close, but intergradation has apparently broken down and disappeared and, in the case of *plumbeicollis*, at least, sufficient time has elapsed for a further secondary racial variation to develop between a very humid Atlantic Coast form and a comparatively dry Pacific form. This race may be known as follows.

***Aramides plumbeicollis pacificus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *A. p. plumbeicollis*, but mantle less tawny, more olive; back more grayish olive; primaries deep rufous instead of chestnut, the dusky tips darker and more extensive; no light buffy feathers on the abdomen; axillars and under wing-coverts chestnut with narrow black bars. Iris orange-red; eyelids, rictus, and skin of mandibular ramus, legs and feet raspberry-red; basal half of bill dull yellow, terminal half pale apple-green. Wing, 176; tail, 58; culmen, 60; tarsus, 80.

TYPE.—No. 143684, Amer. Mus. Nat. Hist.; ♂ ad.; Tipitapa, Nicaragua; April 28, 1917.

SPECIMENS EXAMINED

Aramides plumbeicollis pacificus.—NICARAGUA, Tipitapa, the type.

Aramides plumbeicollis plumbeicollis.—HONDURAS, Roman River, 1 ♂, 1 ♀; NICARAGUA, Río Coco, 2 ♂, 2 ♀, 1?, Jalapa, 1 ♂, 2 ♀, Matagalpa, 1 ♀, Los Sabalos, 1 ♀.

Besides the type, one other bird was collected, but was saved as a skeleton. There are three mounted specimens in the Managua Museum. The bird is found in the swampy borders of Lake Managua, a very narrow habitat, as the surrounding country is quite arid.

It will be noted that this race approaches *cajanea* in that the breast and abdomen are uniform chestnut. The axillars and under wing-coverts render it unique, however, in this group. In *mexicanus*, *albiventris*, and *plumbeicollis* these parts are barred black and hazel, to use Mr. Bangs' term, the tips of the feathers frequently being whitish. In *cajanea* these feathers are similar, but the black bars are much broader, and the light tips are slightly fainter. These characters plus the others mentioned in the diagnosis make us feel justified in describing this race on a single specimen.

THE RACES OF *Aramus vociferus*

The Limpkin found in Florida, the Greater Antilles, and Central America, always a local bird, has had a somewhat stormy nomenclatural career, but in spite of the many names it has borne, no one ever seems to have had the intention of dividing it into two or more forms. Systematic study of the larger water-birds is frequently hampered by scanty material, and this is undoubtedly responsible in the present case for the fact that an excellent subspecies of *Aramus vociferus* has been completely overlooked. Very satisfactory material shows that *Aramus vociferus* is restricted to southern peninsular Florida, and that birds from the Greater Antilles and Central America are a readily recognizable race which must be known as follows.

***Aramus vociferus holostictus*¹ (Cabanis)**

SUBSPECIFIC CHARACTERS.—Similar to *A. v. vociferus* of Florida, but much smaller; the ground color very slightly darker and more glossy above, much darker below; noticeably distinct in the great reduction of the white streaking on upper back, scapulars, wing-coverts, and underparts.

SPECIMENS EXAMINED

Aramus vociferus vociferus.—FLORIDA, 9 ♂, 2 ♀, 2 imm.

Aramus vociferus holostictus.—HAITI, 1 ♀, 1 ♀ ?; TEXAS, 1 ♂; MEXICO, 4 ♂, 3 ♀, 3 imm.; NICARAGUA, 1 ♂, 1 ?.

MEASUREMENTS

		Wing	Culmen	Tarsus
Florida	7 ♂	312-334	124-134	123-135
	2 ♀	306-340	112-124	117-129
Haiti	2 ♀	304-309	95- 99	101-109
	6 ♂	290-315	92-126	104-125
Central America	3 ♀	306-319	103-118	102-122

The great difference in the amount of white streaking is the most striking thing about the new subspecies, *holostictus* in this respect being a decided approach to the South American *scolopaceus*, which has no streaking on the mantle and wing-coverts at all. Typical *vociferus* below has almost as much white showing as dark olive-brown, while *holostictus* has much more brown than white, especially on the belly.

The nomenclature calls for some comment. Of the various names by which *vociferus* has been known, *pictus* Bartram is non-binomial; *giganteus* Bonaparte, 1825, founded on the Florida bird, is a synonym of *vociferus*; *guarauna* Wagler (nec Neuwied) is a synonym of *scolopaceus*, leaving *holostictus* Cabanis, 1856, founded on a Cuban bird, which is, so far as

¹This name has already been revived for the Cuban bird by Outram Bangs, as an insular race of *vociferus*.

ERRATA

For the last two paragraphs on page 13, substitute as follows:—

This remarkable little Kite occurs in Central America only in western Nicaragua, where it is common. Mr. Charles Chubb of the British Museum has recently proposed¹ the name *leona* for these birds. His race was based apparently on one specimen which was alleged to differ from typical *swainsoni* in having the upper surface darker and in having the forehead and sides of the face straw-color instead of orange-buff.

Comparison of four Nicaraguan specimens with a large series from South America shows that while the Nicaraguan birds are very slightly darker above than many, they are lighter than others, showing that nothing but individual variation is involved. The intensity of the color of the forehead and sides of the face is equally variable. However, the Nicaraguan birds are separable from Matto Grosso specimens, representing true *swainsoni*, in having more extensively rufous flanks and sides. We are unable to distinguish the recently described *meridensis* of Swann from the Nicaraguan race. The former, therefore, becomes a synonym of *leona*, to which we also refer specimens from Santa Marta and the north coast of Venezuela.

WALDRON DE WITT MILLER AND LUDLOW GRISCOM.

we know, available, in spite of the fact that Cabanis was only intending to separate the more northern species from *scolopaceus*, apparently unaware that this had already been done by both Latham and Bonaparte.

The two races will stand as follows, with their principal synonymy. It should be noted that both forms will have a place in the A. O. U. Check-List.

1. ***Aramus vociferus vociferus* (Latham)**

Numenius vociferus Latham, (1801), Suppl. Index Orn., LXV, (Florida).

Tantalus pictus Bartram, (1792), 'Trav. Florida,' p. 291.

Aramus scolopaceus of authors (not Gmelin).

Rallus giganteus Bonaparte, (1825), Journ. Acad. Philad., V, p. 31, (Florida).

RANGE.—Southern peninsular Florida; Okefinokee Swamp, Georgia; casual north to South Carolina.

2. ***Aramus vociferus holostictus* (Cabanis)**

Notherodius holostictus Cabanis, 1856, Journ. f. Ornith., p. 426 (Cuba).

Aramus holostictus Selater and Salvin, 1859, Ibis, p. 227 (Belize, Omoa); Salvin, 1870, Ibis, p. 116 (Costa Rica).

RANGE.—Greater Antilles; Eastern Mexico to Panama; accidental in Texas (Brownsville, May 29, 1889, specimen examined).

THE STATUS OF *Gampsonyx swainsoni leonæ* CHUBB

This remarkable little Kite occurs in Central America only in western Nicaragua, where it is common. Mr. S. H. Chubb of the British Museum has recently proposed¹ the name *leonæ* for these birds. His race was based apparently on one specimen which was alleged to differ in having the upper surface darker and in having the forehead and sides of the face straw-color instead of orange-buff.

In spite of the fact that geographic isolation might well have caused subspecific variation, we find it impossible to maintain this race. Comparison of four Nicaraguan specimens with a large series from South America shows that while the Nicaraguan birds are very slightly darker above than many, they are lighter than others, showing that nothing but individual variation is involved. The intensity of the color of the forehead and sides of the face is equally variable. The Nicaraguan birds consequently, should be known as *Gampsonyx swainsoni meridensis* Swann, a recently described subspecies, to which we also refer specimens from Santa Marta and the north coast of Venezuela.

¹1919, Bull. B. O. C., XXXIX, p. 22.

59.7, 5 (729.6)

A NEW POMACENTRID AND BLENNY FROM THE BAHAMAS

BY JOHN TREADWELL NICHOLS

A small collection of rock pool-fishes obtained by Mr. VanCampen Heilner in the Berry Islands of the western Bahamas in February, 1921, contains the following species here proposed as new.

***Eupomacentrus nepenthe*, new species**

The type, our only specimen, No. 7768, American Museum of Natural History, was taken from rock-pools in the Berry Islands, February 24, 1921, by VanCampen Heilner. It is 61 mm. long to base of caudal. Depth, 2.2 in this length; head, 3.2. Eye and snout equal, 3.4 in head; interorbital and maxillary equal, 3.8; greatest

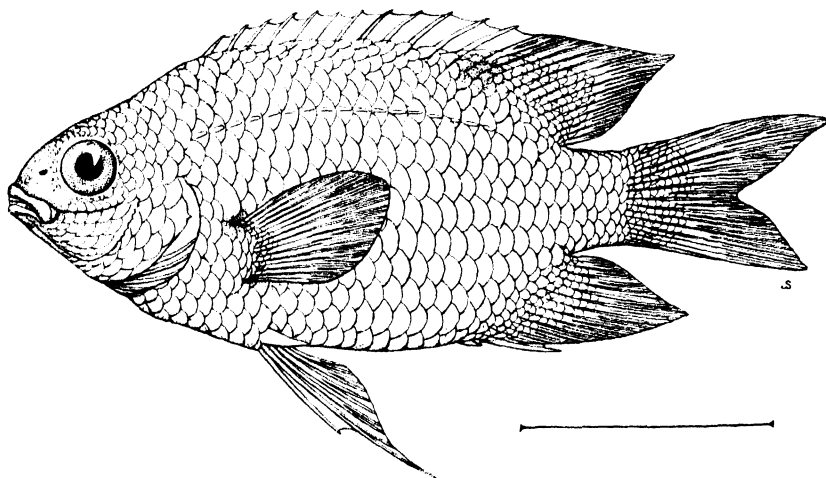


Fig. 1. *Eupomacentrus nepenthe*, type (scale 1 inch).

thickness of body, 1.6; least depth of peduncle, 2.1; longest dorsal spine (last), 1.9; longest dorsal and anal rays (equal), 1.1; second anal spine, 1.9; upper caudal lobe (longest), 0.9; pectoral 1.2; ventral, 0.8.

Dorsal XII, 15; anal II, 13; ventral filaments extend to anal; soft dorsal and anal pointed; scales 28.

The forehead is less elevated than in *Eupomacentrus leucostictus*, with a distinct shallow concavity in the profile back of the eye. The snout is longer, maxillary not reaching to under eye, head larger. Unlike *Eupomacentrus fuscus*, there are many distinct small accessory scales on

the top of the head from the interorbital forward. Color (in spirits) pale, somewhat clouded with dusky above. A small dusky spot on the axil of the pectoral and two or three vague dusky bars in the middle of the side. Pectoral and caudal pale; dorsals, ventrals, and anal more or less washed with dusky, and a vague dusky mark at the base of the first soft dorsal rays. The collector remembered it as uniform dark bluish in life.

Named for the "Nepenthe," a cruising launch, in which the collector has explored the waters of our Atlantic coast.

***Labrisomus heilneri*, new species**

The type, No. 7769, American Museum of Natural History, was collected from rock-pools in the Berry Islands, February 24, 1921, by VanCampen Heilner. It is 61 mm. long to base of caudal. Depth, 4.1 in this length; head, $3.0\frac{1}{2}$. Eye, 4.0 in head; maxillary, 2.0; greatest thickness (the back of the head), 1.5; depth of peduncle, 4.0; longest dorsal spine, 2.9; dorsal ray, 1.8; anal spine, 6.7; anal ray, 2.2; pectoral, 1.3; ventral, 1.5; caudal, 1.7. Interorbital in eye, 2.5.

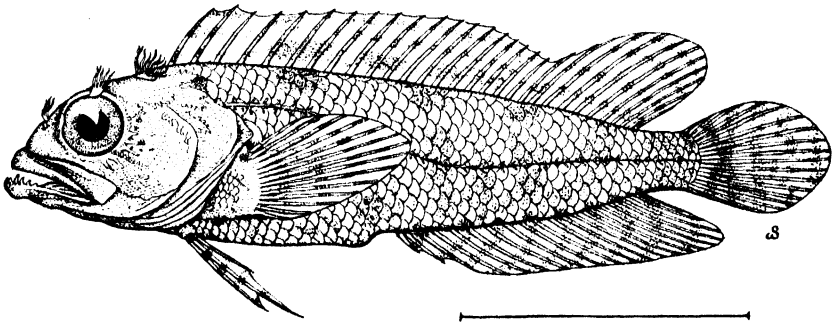


Fig. 2. *Labrisomus heilneri*, type (scale 1 inch).

Maxillary extends back to beyond center of eye. A much divided tentacle over and another before eye, and fringe of tentacles at the nape. Gill-rakers very small, about 9 on the lower limb of the first arch. Dorsal XX, 10. The third dorsal spine shorter than the second and fourth, the nineteenth the shortest, shorter than the twentieth. Anal II, 19. Scales 49; 3 rows between lateral line and front of spinous dorsal; 4 rows between lateral line and front of soft dorsal; about 7 rows between lateral line and front of anal. Color pale with 5 irregular broken dark bars across the side. Pectoral and dorsal marked, ventral, anal and caudal barred with dark; barring on the anal sharp, blackish.

A smaller individual with the same data, 41 mm. to base of caudal, has head, 3.2; eye, 2.6; dorsal XIX, 11; anal II, 17; scales about 50. Five darkish bars across side, the last at base of caudal; fins colorless.

Named for Mr. VanCampen Heilner of Spring Lake, New Jersey, author of "The Call of the Surf," "Record North American Fishes," etc.

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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM BRAZIL, PARAGUAY, AND ARGENTINA

BY GEORGE K. CHERRIE AND (Mrs.) ELSIE M. B. REICHENBERGER

The following descriptions of proposed new birds are based chiefly on birds contained in the Roosevelt Collection made by Mr. Cherrie in the years 1913-1916. They are here published in advance of a complete report on the collection.

***Strix chacoensis*, new species**

SPECIFIC CHARACTERS.—Similar to *Strix rufipes* but general color above and bars below darker; blackish, instead of chocolate-brown, the primary coverts distinctly barred with rufous on both webs, and with facial ruff dusky, barred with grayish white, instead of chocolate-brown or fulvous.

TYPE.—No. 149,387, Amer. Mus. Nat. Hist.; ♂ ad.; Fort Wheeler, Paraguayan Chaco, Paraguay; September 28, 1916; George K. Cherrie.

DESCRIPTION OF TYPE.—Above, dusky brownish black, narrowly barred with white and yellowish buff; the white bars, subapical on the feathers and separated from the basal yellowish buff ones, which are mostly concealed by a rather broad brownish black band; the feathers of the hind neck are long and fluffy; the center of the crown is darker than the upperparts, the blackish tips to the feathers being broader and concealing the white bars; median and greater wing-coverts distinctly but irregularly barred with pale tawny buff and notched on the outer webs with white; on the greater coverts these white tips forming a narrow band; the primary coverts dusky brownish distinctly barred with deep ochraceous buff; the white bars on the scapulars very distinct; quills dusky brown barred (broadly on the primaries, narrowly on the secondaries) on both webs with ochraceous orange but shading into light ochraceous buff on the edges of the outer webs; tail dusky brown crossed with six bars of pale ochraceous buff that shades into buffy white near the edges of the feathers; loral plumes silvery white but with the shafts of the plumes developed into black hair-like bristles; remainder of the facial disk dusky grayish white with concentric bars of dusky brown; ear-coverts grayish white with nearly obsolete dusky brown bars and silvery white shaft-lines; under surface of body barred, blackish brown and white; middle of belly, sides of flanks, thighs, and tarsi ochraceous buff; under tail-coverts light ochraceous buff tipped with white and having a subterminal black band followed by a white one; under wing-coverts and axillaries ochraceous buff, a few of the lowermost outermost dusky brownish; the basal third (more or less) of the inner webs of the primaries and secondaries uniform pale ochraceous buff. ♂: wing, 251; tail, 146; culmen, 33 mm.

SPECIMENS EXAMINED

Strix chacoensis.—PARAGUAY: Paraguayan Chaco, Fort Wheeler, 1 ♂ (type).

Strix rufipes.—CHILE: Maquehue, Temuco, Cautin, 1 ♂, 1 ♀.

Although we have only one specimen of this form its characters are so well marked that we have no hesitation in describing it as a new species. *Strix rufipes* has been recorded by Dr. Dabbene from the western part of the Province of Jujuy, Argentina, but whether the record is based on true *rufipes* or the bird here described we are unable to say.

***Ortalis canicollis pantanalensis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Ortalis canicollis canicollis* of the Paraguayan Chaco, but uniformly darker both above and below; the chestnut color on the outer rectrices more restricted and the head dusky brown; top of the head dusky brown shading into olive-brown on the neck and becoming grayish in the supraloral and supra-auricular regions; bristle-like feathers of the anterior part of the cheeks and chin black, shading into the gray of the sides of face and throat; back of neck, mantle, wings, center of lower back and upper tail-coverts olive-brown with slight bronze or purplish gloss; under wing-coverts, sides, flanks, and under tail-coverts chestnut; chest and breast brownish or olivaceous gray, washed with chestnut on the belly; three outer pairs of tail-feathers broadly tipped with chestnut, the distal third of the outer pair being so colored. ♀: wing, 239; tail, 252; culmen, 25; tarsus, 66 mm.

TYPE.—No. 127,232, Amer. Mus. Nat. Hist.; ♀, ad.; near mouth of Rio San Lorenzo, Matto Grosso, Brazil; December 26, 1913; George K. Cherrie.

***Ortalis canicollis grisea*, new subspecies**

SUBSPECIFIC CHARACTERS.—Very similar to *Ortalis canicollis canicollis* of the Paraguayan Chaco but smaller, the throat dark gray, breast and chest gray with an olivaceous wash; tail bluish green, instead of brownish green, the two outer pair only of tail-feathers tipped with chestnut; sides and flanks pale dusky rufous instead of chestnut as in *Ortalis c. canicollis*; top of head uniform dark gray shading into olive-gray on the nape and becoming brownish olivaceous on the back with a slight bronze gloss; lower back and rump washed with chestnut rather browner down the middle; throat dark gray, breast and chest gray with an olivaceous wash; abdomen paler gray with faint rufescent wash; under tail-coverts chestnut; flanks and sides pale dusky rufous; the two outer pair only of tail-feathers tipped with chestnut. ♀: wing, 210; tail, 238.5; tarsus, 58; culmen, 23 mm.

TYPE.—No. 140,257, Amer. Mus. Nat. Hist.; ♀, ad.; Suncho Corral, Santiago del Estero, Argentina; April 22, 1916; Miller and Boyle.

SPECIMENS EXAMINED

Ortalis canicollis grisea.—ARGENTINA: Suncho Corral, Santiago del Estero, 800 feet, 1 ♀ (type).

Ortalis canicollis canicollis.—PARAGUAY: Fort Wheeler, 1 ♂, 1 ♀. ARGENTINA: Embarcacion, Prov. of Salta, 1700 feet, 1 ♀ (intermediate between *grisea* and *canicollis*).

Ortalis canicollis pantanalensis.—BRAZIL: Palmiras, Rio Taquary, 1 ♀; Rio San Lorenzo, 1 ♀.

Ortalis ruficauda.—VENEZUELA: Cristobal Colon, Paria Peninsula, 1500 feet, 2 ♂, 2 ♀; Tucacas, Estado Falcon, 2 ♂.

This group shows considerable geographic variation. The bird from the Rio San Lorenzo, Matto Grosso (*Ortalis c. pantanalensis*), is the brown extreme; the bird from Suncho Corral, Santiago del Estero, Argentina, is the gray extreme of the species. Specimens from Fort Wheeler, Paraguay (*Ortalis c. canicollis*) and a specimen from Embarcacion, Prov. de Salta, Argentina are intermediate in color. We believe, however, that the material at hand warrants the recognition of three races.

These birds are found in forested areas. *Ortalis c. pantanalensis* was found in the forests which border the watercourses traversing the plains. *Ortalis c. grisea* and *Ortalis c. canicollis* (intermediate) were found in a rough or broken highland forested country. In going from the Paraguayan Chaco into the pantanal region of Matto Grosso, there is a marked difference in the brush and tree flora.

KEY TO THE *Ortalis ruficauda canicollis* GROUP

- A. Only middle pair of tail-feathers without rufescent tips. *Ortalis ruficauda*.
- AA. Six or eight central tail-feathers without rufescent tips.
 - b. Head gray.
 - c. Six middle tail-feathers without rufescent tips; sides dark chestnut, this color nearly meeting across the rump, wing larger, ♀, 227.5 mm. *Ortalis canicollis canicollis*.
 - cc. Eight middle tail-feathers without rufescent tips; sides pale rufescent, wing smaller, ♀, 210 mm. *Ortalis canicollis grisea*.
 - bb. Head brown.
 - c. Six middle tail-feathers without rufescent tips.
 - Ortalis canicollis pantanalensis*.

***Nystactes tamatia interior*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Nystactes tamatia tamatia* but differing from all described races of *Nystactes tamatia* in its longer wing, in being less heavily spotted, and in having no black spots on the center of the abdomen. ♂: wing, 78; tail, 61.5; culmen, 22.5 mm.

TYPE.—No. 127,486, Amer. Mus. Nat. Hist.; 1 ♂; Campos Novos, Cerro do Norte, Matto Grosso, Brazil; February 16, 1914; George K. Cherrie.

SPECIMENS EXAMINED

Nystactes tamatia interior.—BRAZIL: Campos Novos, Cerro do Norte, Matto Grosso, 1 ♂, 1 ♀, (incl. type); Tapirapoan, 1 ♀.

Nystactes tamatia tamatia.—BRITISH GUIANA: 2 ♀.

Nystactes tamatia hypnaleus.—BRAZIL: Santarem, 2 ♀, 1 ♀.

Nystactes tamatia pulmentum.—ECUADOR: Napo, 1 ♀.

MEASUREMENTS

	Sex	Wing	Tail	Culmen
<i>Nystactes tamatia tamatia</i>				
British Guiana	?	72.	64.	24.
"Gu'iana"	?	75.	60.5	23.
<i>Nystactes tamatia hypnaleus</i>				
Brazil: Santarem	?	77.	66.	26.
" "	?	74.	62.	24.
" "	♀	79.	69.	25.5
<i>Nystactes tamatia pulmentum</i>				
Ecuador: Napo	?	75.	59.	24.
<i>Nystactes tamatia interior</i>				
Brazil: Matto Grosso, Campos Novos	♂	78.	61.	22.5
" " " " "	♀	82.5	68.5	25.
" " " Tapirapoan	♀	80.	67.5	23.

The discovery of this race extends the known range of its species. We have seen no specimens from Cayenne, the type-locality of *Nystactes tamatia tamatia*, but we presume material from British Guiana to be essentially topotypical.

***Nonnula ruficapilla pallida*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Nonnula ruficapilla ruficapilla*, but generally paler, the gray of the sides of the head and throat not encroaching on the breast and much less extended on the sides; middle of belly pale ochraceous buff, upperparts and tail olive-brown. ♀: wing, 61.5; tail, 63; culmen, 22.5 mm.

TYPE.—No. 127,126, Amer. Mus. Nat. Hist.; ♀ ad.; Tapirapoan, Matto Grosso, Brazil; January 14, 1914; George K. Cherrie.

SPECIMENS EXAMINED

Nonnula ruficapilla pallida.—BRAZIL: Matto Grosso, Tapirapoan, 2 ♂, 1 ♀, (incl. type).

Nonnula ruficapilla ruficapilla.—PERU: Tulumayo, 4000 ft., Prov. Junin, 2 ♂, 1 ♀, 1 ?.

It is obvious that this subspecies is a pale representative of the Peruvian bird.

***Chloronerpes flavigula magnus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Chloronerpes flavigula flavigula*, but larger throughout, especially in the length of the wing, and with a heavier bill. ♀: wing, 122; tail, 63; culmen, 21 mm.

TYPE.—No. 127,495, Amer. Mus. Nat. Hist.; ♀ ad.; Monte Cristo, Matto Grosso, Brazil; March 18, 1914; Leo E. Miller.

SPECIMENS EXAMINED

Chloronerpes flavigula magnus.—BRAZIL: Matto Grosso, Monte Cristo, 1 ♂, 1 ♀, (incl. type); Santarem, 1 ♀.

Chloronerpes flavigula flavigula.—BRITISH GUIANA: 1 ♂, 1 ♀; Tumatumari, Potaro River, 250 feet, 3 ♂; Potaro Landing, 1 ♀; Rockstone, Essequibo River, 150 feet, 2 ♀. VENEZUELA: La Union, Caura, 2 ♂, 2 ♀; Suapure, 1 ♀; foot of Mount Duida, 1 ♀.

MEASUREMENTS				
	Sex	Wing	Tail	Culmen
<i>Chloronerpes flavigula flavigula</i>				
British Guiana: Tumatumari, Potaro River	♂	118.	65.	20.
British Guiana: Tumatumari, Potaro River	♂	113.5	64. ¹	18.5
British Guiana: Tumatumari, Potaro River	♂	117.5	61. ¹	20.
British Guiana	♂	114.	65.	17.
" "	♀	117.5	66.	19.
" " Rockstone, Essequibo River	♀	113.	64.5	19.5
British Guiana: Rockstone, Essequibo River	♀	114.5	63.	19.
British Guiana: Potaro Landing	♀	113.	60.	18.5
Venezuela: La Union, Caura	♂	114.	66.	19.
" " " "	♂	112.	58.	19.
" " " "	♀	114.	65.	19.5
" " " "	♀	109.	60.	18.
" Suapure	♀	117.5	66.5	19.
" foot of Mount Duida	♀	117.5	65.	19.
<i>Chloronerpes flavigula magnus</i>				
Brazil: Monte Cristo	♂	121.	62.	21.
" " "	♀	122.	62.	21.
" Santarem	♀	123.	64.	18.5

We have seen no birds from Cayenne, the type-locality of *Chloronerpes f. flavigula*, but we believe material from British Guiana to be essentially topotypical. We refer the specimen from Santarem to *Chloronerpes f. magnus*. The wing measurement of this bird is greater than in any other specimen, although the culmen is intermediate in size.

***Furnarius rufus paraguayæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Furnarius rufus rufus*. The upperparts slightly darker, crown browner, and forehead deeper rufescent, size much smaller. ♂: wing, 87.5; tail, 65.5; culmen, 19 mm.

TYPE.—No. 149,516, Amer. Mus. Nat. Hist.; ♂ ad.; Puerto Pinasco, Paraguay; September 5, 1916; George K. Cherrie.

¹Tail moulting.

SPECIMENS EXAMINED

Furnarius rufus paraguayæ.—PARAGUAY: Puerto Pinasco, 1 ♂ (type); Trinidad, 1 ♂.

Furnarius rufus rufus.—ARGENTINA: Buenos Aires, 3 ♂; Montevideo, 1 ?.

Furnarius rufus badius.—BRAZIL: La Raiz, foot of Organ Mountains, 2 ♂.

Furnarius rufus commersoni.—BRAZIL: Chapada, Matto Grosso, 3 ♂, 3 ♀; Urucum, near Corumbá, Matto Grosso, 3 ♂, 4 ♀. ARGENTINA: Perico, Prov. of Jujuy, 1 ♂; Embarcacion, Prov. of Salta, 2 ♂.

MEASUREMENTS

<i>Furnarius rufus paraguayæ</i>	Sex	Wing	Tail	Culmen
Paraguay: Puerto Pinasco, Rio Paraguay	♂	87.5	65.5	19.
“ Trinidad	♂	93.	66.5	17.
<i>Furnarius rufus rufus</i>				
Argentina: Buenos Aires	3 ♂	97-113	68-76	20-21.5
Uruguay, Montevideo	?	101.	78.	21.5

A series from the mountains of Bolivia, Parotani, Department of Cochabamba and from the vicinity of Sucre, Department of Chuquisaca (alt. 8600-8700 feet), as well as a series from Argentina, Province of Jujuy and Province of Salta (alt. 4000 feet), are intermediate between *Furnarius r. rufus* and *Furnarius rufus commersoni*, for they have the nape as rufescent as *F. rufus commersoni*, and the color of the lower parts nearer to *F. rufus rufus*.

These birds are found chiefly at the edges of the heavily forested areas that separate the open country cultivated or otherwise. They seem to show a decided preference for building their nests in or near native houses, and are quite fearless.

56.4.53 (116:729.1)

NEW SPECIES OF AMMONITE OPERCULA FROM THE
MESOZOIC ROCKS OF CUBA

BY MARJORIE O'CONNELL

INTRODUCTION

Among the material collected by Mr. Barnum Brown in 1919 in the Province of Pinar del Rio, western Cuba, are seventeen specimens and numerous fragments of the small calcareous, bivalved shells which are known as aptychi. They are the opercula with which the ammonites closed up the aperture of the conch after the animal had withdrawn into the body chamber.

So far as I know there has been only one occurrence noted of an *Aptychus* in American Mesozoic formations. Castillo and Aguilera described *Aptychus mexicanus* from the Jurassic rocks of Sierra de Catorce, San Luis Potosi, Mexico,¹ and this seems to have been a sporadic occurrence. But in Cuba there is a definite horizon which has been traced for several miles and at which nothing but aptychi and an occasional small *Haploceras* are found. The rocks consist of alternating shales and limestones with the former predominating. They are dark gray but weather light brown or almost white and show a considerable amount of iron stain. The aptychi occur on the surfaces of the shale and are well preserved, although very fragile on account of the iron impregnation. The *Aptychus* beds were discovered in the heart of the Organ Mountains in outcrops along two stream beds, the Rio San Cristobal and Rio Hondo, northeast of the town of San Cristobal and northwest of Candelaria. From the field relations and the general stratigraphy, these strata appear to be of Upper Jurassic age, but the aptychi themselves possess certain characteristics which have heretofore been found only in Cretaceous species. Until further field work can be done it is impossible to state the exact age of the beds but it must be either Tithonian or Neocomian with the palæontological evidence strongly favoring the latter.

¹Castillo, Antonio del and Aguilera, Jose G. 1895. 'Fauna Fossil de la Sierra de Catorce, San Luis Potosi.' Boletin de la Comision Geologica de México, I.

HISTORY OF INVESTIGATIONS AND CLASSIFICATION OF OLD WORLD
APTYCHI

Hermann von Meyer in his paper 'Das Genus *Aptychus*' (1831), proposed the generic name *Aptychus* for the paired plates found within the body chamber of many species of ammonites. While he did not recognize the true significance of the plates, he distinguished correctly between two different types which he described as *A. lævis* and *A. imbricatus*, each with two varieties. These have since been recognized as representatives of two large groups, the Cellulosi and the Imbricati, respectively.

There is no monographic work on *Aptychus*, the descriptions of species being scattered through the literature in short papers. Since the opercula are often found in formations containing few or no ammonites, it would be exceedingly valuable if all of the data concerning the geological range of every known species of *Aptychus*, as well as the ammonite genera to which they belong could be brought together. Such a study would have to be undertaken in Europe where *Aptychus* beds are common, for in America up to the present few representatives of this genus have been found and material is not available for carrying on researches on the subject. On page 12 below is given a short and by no means complete bibliography of the more important references dealing with the morphology and taxonomy of aptychi and the stratigraphic range of Jurassic and Cretaceous species.

The systemic position of the bivalved *Aptychus* plates was formerly a subject for much discussion and a large amount of the early literature was devoted to it. The various theories advanced concerning the type of organisms to which the aptychi belonged may be found in the contributions by Parkinson (1811), Meyer (1831), Voltz (1837), Coquand (1841), and Quenstedt (1849). It is now generally accepted that the aptychi are ammonite opercula, as is indicated by their position *in situ* in the body chamber in many specimens. Oppel has figured and described, from the Solnhofen beds of Bavaria, a large number of ammonites with aptychi in the body chamber or at the aperture (see reference on p. 13 for Oppel 1863) and other authors have recorded sporadic occurrences of aptychi *in situ* (e.g., Meyer, 1831, Retowski, 1891, 1893).

Aptychus is not a genus; it is simply a convenient term for referring to opercula when the ammonites to which they belong are unknown. When an aptychus is found *in situ* in an ammonite it does not receive a separate specific name but is known as the aptychus of that particular genus and species of ammonite. But when aptychi occur alone, as they

frequently do, with no ammonites in the same stratum, then for convenience in referring to them they are given specific names. If an aptychus thus named is subsequently found to be the operculum of an ammonite which had previously been described, the aptychus should be called by the specific name of the ammonite, while the specific name which had been used for the aptychus would become a synonym. Each species of ammonite that possessed an operculum in all probability possessed a distinctive type and, conversely, when different types of aptychi are found we may assume that they belonged to separate ammonite species.

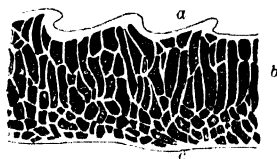


Fig. 1. Vertical section of the shell of *Aptychus profundus* Voltz, showing the three shell layers (a, b, c).

Greatly magnified. Upper Jurassic (after Meneghini and Bornemann from Zittel).

When aptychi are sectioned they are found to be made up of three shell layers of which the inner and outer are very thin and dense, while the middle is thick and cellular or tubular (Figs. 1, 2, 4, 6). The outer and inner layers are frequently destroyed during fossilization, leaving

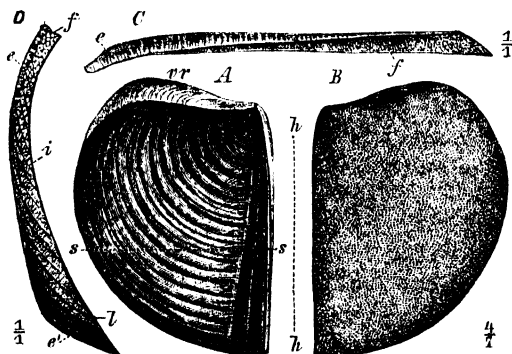


Fig. 2. *Aptychus lavis* Meyer, the aptychus of a species of *Aspidoceras*.

A. Interior view of a valve showing the growth-lines. B. Exterior of same; h-h, junction line. C. Inner edge of the valve; f, junction surface. D. Vertical section through the valve along the line s-s, of A; i, growth-lamellae merging externally (c) but thickening toward the interior (l). Upper Jurassic, Kimmeridgian, Le Havre, France. (After Steinmann.)

the more resistant middle one. Aptychi increase in size by the addition of concentric bands of shell around the periphery. The edges of these bands, covered only by the thin outer layer, may show on the convex surface like the ends of off-lapping shingles or they may bend over each other so closely as to show only concentric lines on the external surface.

The internal surface is marked by crowded growth-lines, which are sometimes crossed by radial lines from the apex.

A classification of aptychi has gradually been evolved and, as added to and emended by Zittel (1885, pp. 402-403), now includes seven groups based on the shape and thickness of the shell, the character of the surface



Fig. 3. *Aptychus lamellosus* Voltz.

Exterior view. Upper Jurassic, Solnhofen, Bavaria. Natural size. (After Zittel.)

layer and of the lamellæ. The three most abundantly represented groups in the Upper Jurassic and Lower Cretaceous (Neocomian) are the Cellulosi, Imbricati and Punctati. The Cellulosi are forms with thick curved plates having a fine porous, convex external surface and a concave internal surface covered with fine growth-lines (Fig. 2). The Imbricati have thinner shells and usually the small posterior end is very thick. The convex surface is covered with shingle-like lamellæ, the edges of which appear like folds in some cases or like sharp knife-edges in others, the crests being separated by depressions which are rounded or angular (Figs. 1 and 3). The inner surface has concentric growth-lines. The aptychi of this group are found in various species of the Oppe-
liniæ in the Upper Jurassic, especially at Solnhofen and in the Lower Cretaceous and are also found isolated in the various *Aptychus* shales and limestones. The Punctati (Fig. 4) are similar to the Imbricati except that the lamellæ overlap more closely

and the crests are bent over until they cover up the intervening hollows; the edges of the crests are marked by lines of punctæ on the external surface. The outer shell layer is thicker than in the Imbricati and the distinctness of the lines of punctæ depends upon the degree to which erosion of this layer has progressed, the punctæ being etched out when the amount of erosion is slight, but if this continues the lamellæ are worn smooth. Illustrations of these types maybe found in the works cited below, especially Quenstedt (1849) and Zittel (1885).

The *Aptychus* shale of Cuba contains three species all belonging to the Imbricati and all well represented. No other fossils have been discovered in this formation except a few small ammonites belonging to the

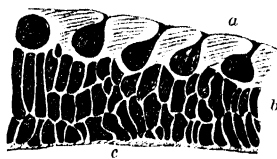


Fig. 4. *Aptychus punctatus* Voltz.

Vertical section showing three shell layers (a, b, c). Greatly enlarged. (After Meneghini and Bornemann from Zittel.)

family of the Haploceratidæ. The determination of the age of the beds therefore depends upon the evidence offered by the aptychi themselves without the aid of the ammonites to which they belonged.

In Europe aptychi have been found throughout the Jurassic and Cretaceous of many regions. In certain localities, particularly in Bavaria in the Solnhofen beds, they are usually found *in situ* in the body chamber of the ammonite shell. Elsewhere they occur segregated in beds by themselves, as is the case in the Tithonian *Aptychus* limestones of the Alps and Apennines and in the Eo-Cretaceous or Neocomian *Aptychus* limestones of the eastern Alps.

The Imbricati, those semi-elliptical to quadratic forms with overlapping lamellæ on the convex surface and fine concentric lines on the concave surface, are the most abundant and widespread. They occur in great numbers associated with cones belonging to the subfamily of the Oppeliinæ and to the family of the Haploceratidæ, and also alone. The Jurassic Imbricati for the most part have the lamellæ parallel to the curved periphery of the outer edge of the aptychus, as in *A. lamellosus* Voltz from the Solnhofen beds (Fig. 3). The lamellæ, in other words, extend in a continuous curve from the anterior to the posterior end, without bending back toward the apex and forming an angle on the posterior slope. All of the Jurassic Imbricati of this type may be united into the *A. lamellosus* group, including the following forms as representative species:

<i>Aptychus crassicauda</i> Quenstedt	Middle White Jura
<i>A. sparsilamellosus</i> Gömbel	Upper Jurassic (<i>Acanthicus</i> beds)
<i>A. lamellosus</i> Voltz	Upper Jurassic (Solnhofen beds)
<i>A. profundus</i> Voltz (= <i>A. imbricatus</i> Meyer)	" " " "
<i>Aptychus</i> of <i>Oppelia bous</i> (Oppel)	" " " "
" " <i>O. euglyptus</i> (Oppel)	" " " "
" " <i>O. lithographica</i> (Oppel)	" " " "
" " <i>O. thoro</i> (Oppel)	" " " "

The Cretaceous Imbricati are distinguished from those of the Jurassic in having the lamellæ bent toward the apex as they approach the line of junction (Figs. 5, 6). In some species, notably *A. didayi* Coquand, there is an acute angle formed on the posterior slope. These forms constitute the *A. didayi* group, including as representative species:

<i>Aptychus angulocostatus</i> Peters	Lower Cretaceous (Neocomian)
<i>A. didayi</i> Coquand	" " "
<i>A. lineatus</i> Peters	" " "
<i>A. pusillus</i> Peters	" " "
<i>A. seranonis</i> Coquand	" " "
<i>A. undatocostatus</i> Coquand	" " "
<i>A. insignis</i> Hébert	Upper Cretaceous (Mæstrichtian)



Fig. 5. *Aptychus didayi* Coquand.

Natural size. Lower Cretaceous, Neocomian, Central France. (After Picotet.)

The same distinction exists between the Jurassic and Cretaceous Punctati, the former having the lamellæ essentially parallel to the outer curved periphery, the latter having them bent into an angle along the posterior slope. As examples of the Jurassic species may be mentioned: *Aptychus punctatus* Voltz and *A. beyrichi* Oppel; of the Cretaceous species: *A. rugosus* Sharpe from the Mæstrichtian of England.

The species found in the *Aptychus* shales north of San Cristobal in Cuba all belong to the Imbricati and to the *didayi* rather than the *lamellosus* group. In all of them the lamellæ are bent more or less sharply on the posterior slope and turn towards the line of junction of the plates, meeting it either at a right angle, as in *A. cubanensis*, or at an acute angle toward the apex, as in *A. pimientensis* and *A. cristobalensis*, but never at an acute angle away from the apex, as in *A. lamellosus* Voltz and related species of that group. The Cuban species are altogether Cretaceous in their appearance, being most like *A. didayi* Coquand and *A. insignis* Hébert. They are smaller than the two latter and narrower than *A. didayi* but the type of lamellæ is the same in all of them. Either the Cuban species belong to the Cretaceous or else they are to be regarded as late Tithonian fore-runners of the Cretaceous types. The following new species are described from the region north and northeast of San Cristobal¹:

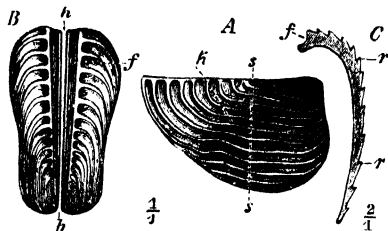


Fig. 6. *Aptychus* of *Haplocceras*.

A. Side view of valve showing posterior angulation; B. Exterior of both valves. Anterior or proximal end below, posterior or distal end above. Lamellæ meet exterior junction line at right angle. *f*, triangular junction surface bounded interiorly by *h-h*, the interior line of junction (*Harmonidialis* or *Symmetridialis*). C. Vertical section through one valve along the line *s-s* in A, showing the folds *r* off-lapping from the inner to the outer margin. Lower Cretaceous, Neocomian of Chalunçon, Drôme, France. (After Steinmann.)

Species	Locality	Locality	Locality	Locality
	No. S. C. 2	No. S. C. 3	No. S. C. 4	No. S. C. 5
<i>Aptychus cristobalensis</i>	1	3		
<i>A. cubanensis</i>	5		3	
<i>A. pimientensis</i>		2		3

¹The details concerning the exact localities are given under the descriptions of the species.

DESCRIPTION OF NEW SPECIES FROM CUBA

Group of the Imbricati

***Aptychus cristobalensis*, new species**

Figures 7 and 8

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19017/3).—The shell is calcareous, thin at the apex (anterior) and thick at the narrow distal (posterior) end. The length of the outer junction line is 29 mm., the greatest width 17 mm. and the cord of the peripheral arc from the distal to the proximal ends is 30.7 mm. The broad truncated end is about 10 mm. long. At the apex the three shell layers together are only 0.3 mm. thick; at the distal end the thickness is 6.0 mm.

The curved periphery is bounded by a narrow smooth shell band, which widens toward the distal end where it is perpendicular to the convex surface of the plate. Each half of the aptychus is nearly flat in the early growth stages. It becomes gently convex along the short diameter but extremely convex along a radial line at about one-third the distance between the long and short diameters. This convexity is so pronounced as to give rise to a ridge from which the shell slopes down abruptly to the external junction line (i. e., the long diameter).

At the apex of each plate there are numerous, almost invisible growth-lines, each of which marks the edge of a lamella. Each additional growth-band is broader than the preceding but the first fifteen lamellæ are so narrow as to be scarcely distinguishable to the naked eye. They are arranged like shingles except that they off-lap instead of overlap away from the apex. The last ten lamellæ are broad but only a few are continuous from end to end of the shell. The last four or five wedge out along the periphery, each succeeding one being shorter. It is in this manner that the shape of the aptychus is determined, the broadest part being in the region where all the lamellæ are present, the narrow end being occupied by only a few. The lamellæ become very thin toward the truncated proximal end and terminate nearly at right angles thereto, there being a narrow smooth band at the edge. In the opposite direction, the lamellæ show a slight offset toward the apex as they approach the convex radial ridge, and after they cross it they curve back toward the apex, ending abruptly at the junction line. This flexure is angular until the aptychus is about half-grown, the angle being slightly less than 90°. On the remainder of the shell the flexure loses its sharp angularity, becoming rounded and more open with a divergence of 110–120°.

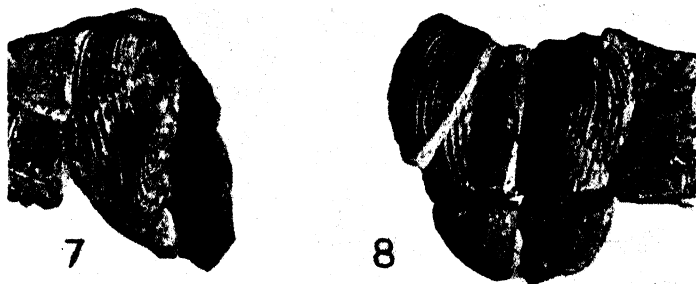
The inner, concave side of the aptychus is covered with fine concentric, evenly-spaced growth-lines about 0.1 mm. apart (Fig. 7).

DESCRIPTION OF PARATYPE No. 19017/2.—Length 30 mm., greatest width about 16 mm., cord of the peripheral arc 33.2 mm. long. Truncated proximal end about 10 mm. long, thickness of distal end 5.5 mm. Outline of two plates in juxtaposition is semi-elliptical. The junction surface is smooth and at right angles to the convex shell surface. It is triangular in shape with its apex at the point of origin of the plate whence it increases to a width of 3.2 mm. at the distal end. It is faintly concave but the three bounding lines are straight. Between the junction plate and the inside or concave surface of the aptychus there is a bevelled edge (Fig. 8).

NUMBER OF SPECIMENS.—Holotype and 3 paratypes.

ASSOCIATED SPECIES.—*Aptychus pimientensis*, new species, at locality No. S. C. 3.

LOCALITIES.—Northeast of Mt. Pimiento in Rio Hondo, 7 miles northeast of San Cristobal (locality No. S. C. 3) 3 specimens, Nos. 19017/1, 19017/2, 19017/3 (holotype); on Finca of Rafael Begoa, 9 miles north of San Cristobal in Rio San Cristobal (locality No. S. C. 2) 1 specimen of immature individual, No. 19017/4.



Figs. 7 and 8. *Aptychus cristobalensis*, new species.

Fig. 7. Oblique side view of one valve showing curvature of lamellæ on posterior slope. The interior of the other valve is shown at the right, the valve being thrust forward. Natural size. Holotype, A. M. N. H. No. 19017/3.

Fig. 8. Top view of both valves in position. Natural size. Paratype, A. M. N. H. No. 19017/2.

Comparisons.—This species belongs to the group of which *Aptychus didayi* Coquand is the most widespread European representative. It is, however, relatively narrower than that species and has much finer lamellæ, while the pronounced flexure of the lamellæ of the fullgrown shell is rounded and not angular. (See Coquand, 1841, p. 389, Pl. ix, fig. 10, and Quenstedt, 1842, p. 314, Pl. xxii, fig. 21.) It agrees very closely with the description of *A. angulocostatus* Peters (1854, p. 441) but that author did not give an illustration of his species and the European types are not accessible to me, so that it would be unsafe to identify the Cuban form with that species. *A. cristobalensis* probably belongs to a species of *Oppelia*.

Horizon of Related European Species.—*Aptychus didayi* Coquand is a characteristic Lower Cretaceous (Neocomian) species occurring throughout the Mediterranean province in southern France, in the eastern Alps, in Austria and northern Africa. (Compare Fig. 7 with Fig. 5.) *Aptychus angulocostatus* Peters is found associated with *A. didayi* in the Neocomian Wienerwald sandstone of Austria and Bohemia (Peters, 1854, p. 441; Paul, 1889, pp. 59, 175).

***Aptychus cubanensis*, new species**

Figures 9 to 14

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19018/2).—Length of the junction line 17 mm.; greatest width of one valve, 9 mm. On the posterior slope the lamellae curve to meet the external line of junction at right angles and assume their maximum size and saliency as they approach this line. The last three or four lamellae to be formed do not extend completely around each half of the aptychus but wedge out

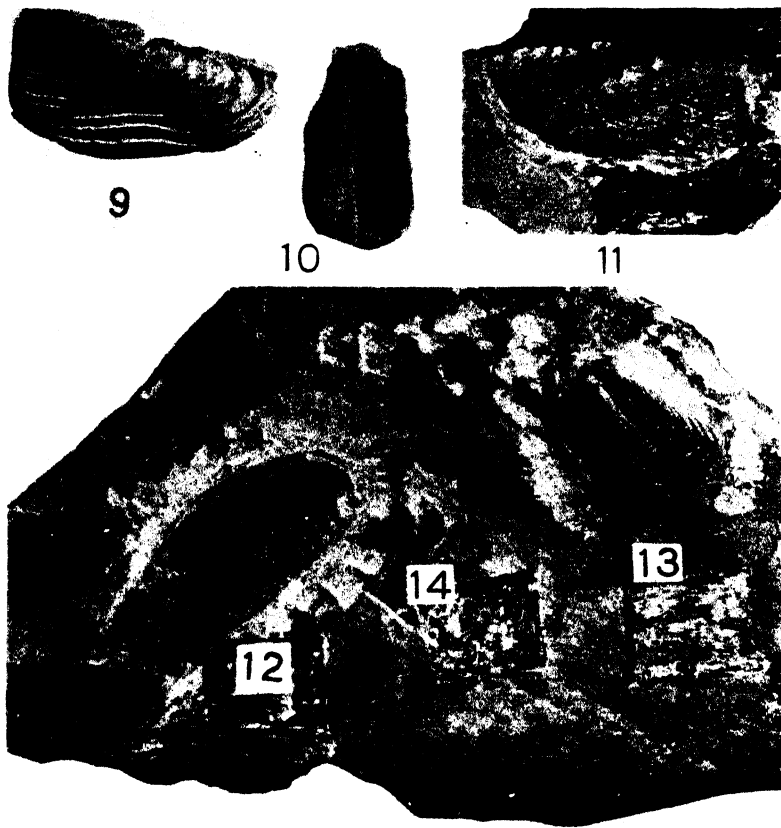
Figs. 9 to 14. *Aptychus cubanensis*, new species.

Fig. 9. Side view showing lamellae meeting external junction line at right angles. $\times 2$. Holotype, A. M. N. H. No. 19018/2.

Fig. 10. Top view of immature aptychus with both valves in juxtaposition. $\times 2$. Paratype, A. M. N. H. No. 19018/1.

Fig. 11. Exterior. $\times 2$. Paratype, A. M. N. H. No. 19018/3.

Fig. 12. View of posterior end of a broken valve showing the lamellae meeting external junction line at right angles. $\times 2$. Paratype, A. M. N. H. No. 19018/6.

Fig. 13. Exterior of two valves of neptonic aptychus. $\times 2$. Paratype, A. M. N. H. No. 19018/7.

Fig. 14. Exterior of immature aptychus showing two valves in juxtaposition along junction planes. $\times 2$. Paratype, A. M. N. H. No. 19018/8.

along the curved periphery. On the long anterior surface the lamellæ are thin and sharp but as they increase in size posteriorly their edges become rounded and they appear more like folds separated by channels than like overlapping knife-edges. The external line of junction is thickened and elevated and it serves to form a very definite boundary for the lamellæ (Fig. 9).

DESCRIPTION OF PARATYPES.—On Specimen 19018/7 (Fig. 13), 11 mm. long, 20 lamellæ were counted, this not being the total number since the finer ones near the apex were too small to be distinguished. The two valves are shown in contact along the junction line and when in this position the posterior slopes are horizontal, while the anterior portions are deflected abruptly downward. The outline as a whole is rhombohedral with the distal end squarish and truncated. The largest specimen (No. 19018/6), which shows only one valve, is approximately 21–22 mm. long and 10 mm. wide (Fig. 12).

The nepionic aptychus (specimen No. 19018/8) is nearly flat, showing only a slight anterior convexity. One of the plates is 3.5 mm. long and 1.8 mm. wide. Thirteen fine, concentric, continuous lamellæ could be counted, although at that early stage they appeared merely as growth-lines, the lamellar character not being visible on the surface (Fig. 14).

The interior concave side of the aptychus is covered by minute, concentric growth-lines. The middle-shell layer is thin near the apex but increases posteriorly. The thickest part of the shell is at the margin on the line of the posterior ridge.

NUMBER OF SPECIMENS.—Holotype and seven paratypes.

ASSOCIATED SPECIES.—*A. cristobalensis*, new species, at locality No. S. C. 2.

LOCALITIES.—On Finca of Rafael Begon, 9 miles north of San Cristobal (locality No. S. C. 2) five specimens, Nos. 19018/1–5; on Finca of Rafael Begon (locality No. S. C. 4) 3 specimens, Nos. 19018/6–8.

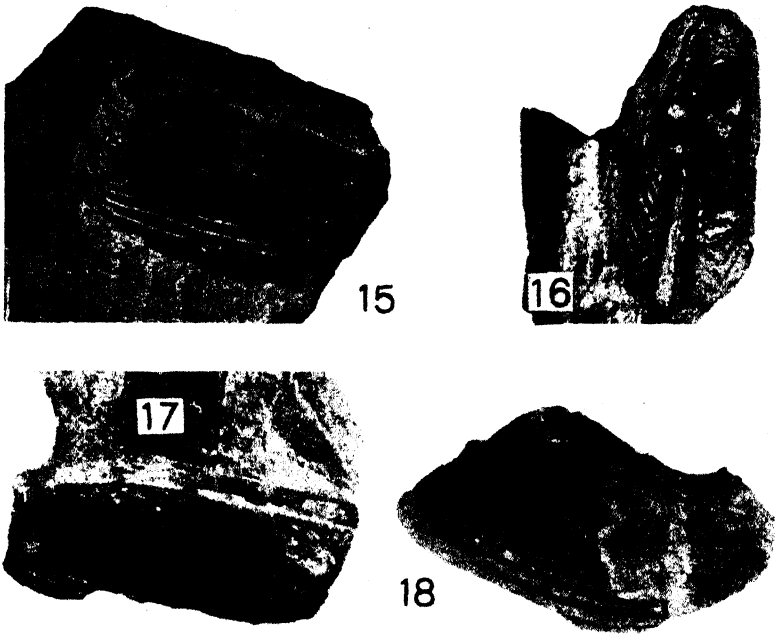
Comparisons.—The distinguishing characteristics of *A. cubanensis* are the angle of curvature of the lamellæ along the posterior ridge and their abrupt, right-angled termination at the external line of junction. These features readily differentiate it from *A. cristobalensis* and *A. pimientensis*, which are found associated with it. The thickening of the lamellæ into folds as they reach the external line of junction is also characteristic. This species appears to be almost identical with the aptychus of *Haploceras* figured by Steinmann (1907, fig. 542) from the Neocomian of Chalançon, Département of Drôme, France, (Fig. 6) except that the Cuban specimens are smaller and they are narrower when viewed from the side. The lamellæ wedge into each other on the side of the valve, while in the French species they are simple and continuous. *Aptychus cubanensis* evidently belongs to a species of *Haploceras*.

***Aptychus pimientensis*, new species**

Figures 15 to 18

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19019/1). This species is small, rhombohedral in outline and with delicately etched surface features. The measurements for one valve are: length 19 mm., width 10.2 mm., length of the truncated proximal end 8.2 mm (Fig. 15).

The lamellæ are fine and close-set; they increase regularly in size and, beyond the apical portion which is broken away, 26 can be counted. The largest ones wedge out against the smooth peripheral band. There is a pronounced radial ridge on the posterior slope; on the posterior side of the ridge the lamellæ turn sharply toward the apex at an acute angle of about 30°. The junction surface is smooth, triangular, with a maximum width of 1.7 mm.; it is at right angles to the convex surface of the shell. The surfaces of all the lamellæ are finely punctate but this character is most clearly visible on the peripheral surface at the thickest part of the shell.



Figs. 15 to 18. *Aptychus pimientensis*, new species.

Fig. 15. Exterior of valve. $\times 2$. Holotype, A. M. N. H. No. 19019/1.

Fig. 16. Exterior of both valves in juxtaposition, showing triangular junction planes and posterior angulation of lamellæ. $\times 2$. Paratype, A. M. N. H. No. 19019/3.

Fig. 17. Side view of crushed specimen showing acute angulation of lamellæ. $\times 2$. Paratype, A. M. N. H. No. 19019/4.

Fig. 18. View of posterior end of one valve, showing costæ wedging out against peripheral margin and also along the side, producing characteristic en echelon notching. $\times 2$. Paratype, A. M. N. H. No. 19019/5.

DESCRIPTION OF PARATYPES.—Specimen No. 19019/4, which is crushed, shows the sharp angulation of the lamellæ on the posterior slope (Fig. 17). Specimen No. 19019/3 shows the two valves in contact along the junction line (Fig. 16). Specimen No. 19019/5 shows the notching of the lamellæ on the anterior slope of the ridge (Fig. 18).

NUMBER OF SPECIMENS.—Holotype and 4 paratypes.

ASSOCIATED SPECIES.—*Aptychus cristobalensis*, new species, at locality No. S. C. 3.

LOCALITIES.—Mt. Pimiento, 5 miles north of San Cristobal, Province of Pinar del Rio (locality No. S. C. 5), three specimens, Nos. 19019/1-3; northeast of Mt. Pimiento in Rio Hondo, 7 miles northeast of San Cristobal (locality No. S. C. 3), two specimens, Nos. 19019/4, 5.

Comparisons.—The most noticeable characteristic of this species is the inflection of the lamellæ at an acute angle as they approach the junction margin. This feature serves as a ready means of distinguishing *A. pimientensis* from *A. cristobalensis* in which the lamellæ are curved, not angular in their inflection. There are also more minute differences: *A. pimientensis* is relatively longer than *A. cristobalensis*, has more even and regular lamellæ, and is rhombohedral instead of semi-elliptical in shape. This species, like the others from the same beds, bears a general resemblance to *A. didayi* from which it differs primarily in shape, being rhombohedral instead of triangular, and having finer, more numerous lamellæ. It probably belongs to a species of *Oppelia*.

BIBLIOGRAPHY OF SOME OF THE MORE IMPORTANT LITERATURE ON THE GENUS *APTYPCHUS*

1811. PARKINSON, JAMES. 'Organic Remains of a Former World.' 3 vols; III, pp. 184-187. (Genus *Trigonellites* (= *Aptychus*) described p. 186; *T. lata*, p. 186, Pl. XIII, figs. 9, 12; *T. lamellosa*, p. 186, Pl. XIII, figs. 10, 11. By the strict rules of priority the name *Trigonellites* should now be used instead of *Aptychus*, but the latter name is firmly rooted in the literature and there is the further consideration that Parkinson considered the opercula to be pelecypods and the name *Trigonellites* is etymologically more appropriate for pelecypods than ammonites.)
- 1830-33. ZIETEN, C. H. 'Die Versteinerungen Württembergs.' (Good illustrations of *Aptychus laevis latus* Meyer (p. 49), Pl. XXXVII, figs. 6 and 7, showing exterior and interior and plates *in situ*.)
1831. MEYER, HERMANN VON. 'Das Genus *Aptychus*.' Nova Acta, XV, pp. 125-170. (Original description of *A. laevis*, p. 128, Pls. LVIII, LIX, figs. 6-9; *A. imbricatus*, p. 139, Pl. LIX, figs. 10-12. Structure of shell, Pl. LIX, fig. 13. Aptychi from the Lias, Pl. LX, figs. 1-7. Aptychi regarded as the shells of mollusks devoured by ammonites, p. 156.)
1837. VOLTZ, PHILIPPE LOUIS. 'Erste Notiz über das Genus *Aptychus*.' Neues Jahrb., pp. 304-312. (General resumé of opinions concerning the nature of aptychi. Voltz considered them to be ammonite opercula.)
1837. 'Zweiter Vortrag über das Genus *Aptychus*.' Neues Jahrb., pp. 432-438. (Classification of 25 species of *Aptychus*, 12 new, into *Cornei*, *Imbricati*, and *Cellulosi*. List of ammonite genera with which aptychi are found *in situ*.)
1841. COQUAND, HENRI. 'Mémoire sur les *Aptychus*.' Bull. Soc. Geol. France, (1) XII, pp. 376-391, Pl. IX. (Summary of previous opinions on the significance of *Aptychus* (pp. 376-386). Considered by Coquand to be genus intermediate between *Loligo* and *Sepia* (p. 387); protographs and

- protologs (pp. 387-390): *A. blainvillei*, p. 387, Pl. ix, figs. 8, 9; *A. beaumonti*, p. 388, Pl. ix, fig. 12; *A. radians*, p. 389, Pl. ix, figs. 11 and 11 bis; *A. didayi*, p. 389, Pl. ix, fig. 10; *A. seranonis*, p. 390, Pl. ix, fig. 13. List of 33 species of *Aptychus* classified and with geological horizon, pp. 390, 391.)
1841. GLOCKER, E. F. 'Ueber den Jurakalk von Kurowitz in Mähren und über den darin vorkommenden *Aptychus imbricatus*.' Nova Acta, XXIX, Suppl. 2, pp. 275-308, Pls. I-III. (Mode of occurrence of *Aptychus imbricatus* in the Jurassic of Kurowitz, pp. 285, 286, 289. Detailed description of examples of this species and of the character of the shell layers, pp. 293-306, Pl. III, figs. 1-7, 9. The species here described is synonymous with *A. punctatus* Voltz and is a typical example of the group of the Punctati.)
1846. GEINITZ, H. B. 'Grundriss der Versteinerungskunde.' (Aptychi discussed pp. 307-310; five species (not new) described.)
1849. QUENSTEDT, F. A. 'Die Cephalopoden.' (Very full descriptions of numerous previously known species, pp. 306-323. Protolog of *A. crassicauda*, p. 314, protograph, Pl. XXII, fig. 25. Of especial interest is description of *A. didayi* Coquand, p. 314, Pl. XXII, fig. 21.)
1854. PETERS, K. 'Die Aptychen der österreichischen Neocomien und oberen Juraschichten.' Jahrb. d. k. k. g. Reichsanstalt, V, pp. 439-444. (Protologs of: *A. angulocostatus*, *A. undatocostatus*, *A. lineatus*, *A. pusillus* (p. 441); *A. rectocostatus*, *A. reflexus* (p. 442); *A. aplanatus*, *A. giganteus* (p. 443). Occurrence of *A. didayi* Coquand in the Neocomian noted (p. 441). *A. latus* Voltz (p. 443), *A. depressus* Voltz and *A. profundus* Voltz (p. 444) reported from the Upper Jurassic of St. Veit and Lainz, Austria.)
1854. PICTET, F.-J. 'Traité de Paléontologie,' 2nd edit. II. (Numerous previously described species listed (p. 558), some figured Pl. XLVII, figs. 10-17. Excellent illustration of *A. didayi* Coquand, Pl. XLVII, fig. 17.)
1854. HÉBERT, E. 'Tableau des Fossiles de la Craie de Meudon.' Mém. Soc. Geol. France, (2) V, pp. 345-374. (Original descriptions of three new species of *Aptychus* from the Chalk of Meudon: *A. insignis*, p. 367, Pl. XXVIII, fig. 6; *A. obtusus*, p. 367, Pl. XXVIII, fig. 7; *A. crassus*, p. 368, Pl. XXVIII, fig. 8.)
1856. SHARPE, D. 'Description of the Fossil Remains of Mollusca found in the Chalk of England.' Pt. III, Cephalopoda. (Aptychi of the Chalk (pp. 53-58). New species described: *A. portlocki*, p. 56, Pl. XXIV, figs. 2, 3, 4, (6?); *A. gollervilleensis*, p. 56, Pl. XXIV, fig. 5; *A. icenicus*, p. 57, Pl. XXIV, fig. 7a, b; *A. rugosus*, p. 57, Pl. XXIV, figs. 8a, b, and 9; *A. peramplus*, p. 58, Pl. XXIV, fig. 10.)
1858. QUENSTEDT, F. A. 'Der Jura.' (Illustrations and descriptions of a number of previously described species.)
1863. OPPEL, ALBERT. 'Ueber jurassische Cephalopoden.' Pal. Mitth. III. (Protographs and protologs of many species of aptychi found *in situ* in ammonites from the Lithographic Limestone of Solnhofen. *Ammonites lithographicus*, p. 248, Pl. LXVIII, figs. 1-3; *A. thoro*, p. 250, Pl. LXVIII, figs. 6, 7; *A. stersapis*, p. 251, Pl. LXIX; *A. bous*, p. 252, Pl. LXX, fig. 1;

- A. euglyptus*, p. 253, Pl. LXX, figs. 1-5; *A. hybonotus*, p. 254, Pl. LXXI, figs. 1-3; *A. autharis*, p. 255, Pl. LXXI, figs. 4-6; *A. latus*, p. 256, Pl. LXXII, fig. 1; *A. pipini*, p. 257, Pl. LXXII, fig. 3; *A. aporus*, p. 258, Pl. LXXIII, figs. 1-3; *A. hoplisus*, p. 259, Pl. LXXIII, figs. 4, 5; *Aptychus* sp., p. 261, Pl. LXXIV, figs. 3, 4. The Solnhofen beds contain the largest Upper Jurassic *Aptychus* fauna so far known.)
1865. SCHAUROTH, CARL VON. 'Verzeichniss der Versteinerungen in Herzogl. Naturaliencabinet zu Coburg.' (Protologs and protographs of: *A. punctatus*, p. 152, Pl. iv, fig. 13; *A. exsculptus*, p. 153, Pl. iv, fig. 14. Occurrences given for *A. latus* Münster and *A. lamellosus* Münster, p. 152.)
1866. BENECKE, E. W. 'Ueber Trias und Jura in den Südalpen.' Geogn.-Pal. Beiträge, I, pp. 1-204. (*A. cf. lamellosus* Voltz and *A. cf. latus* Münster reported in *Acanthicus* beds, p. 185, *A. curvatus* Giebel, *A. cf. gigantis* Quenstedt reported from Diphyakalk (p. 192). *A. didayi* recorded as characteristic of the Biancone (Neocomian) formation, p. 135.)
1866. OPPEL, ALBERT. 'Ueber die Zone des *Ammonites transversarius*.' Geogn.-Pal. Beiträge I, Heft 2, pp. 207-316. (References to the occurrence of aptychi species, pp. 218, 234, 252, 279. Occurrence of *Aptychus didayi* in Neocomian of Algeria, p. 273.)
1867. WAAGEN, WILHELM. 'Ueber die Ansatzstelle der Haftmuskeln beim Nautilus und den Ammoniden.' Palaeontographica, XVII, pp. 185-210, Pls. XXXIX and XL. (Discussion of the position of the aptychus in the body chamber of ammonites, pp. 192, 193; illustrations on Pl. XL.)
1868. ZITTEL, KARL A. 'Die Cephalopoden der Stramberger Schichten.' (Discussion of characters of *Aptychus*, pp. 49-52; description of Stramberg species (pp. 52-55); *A. punctatus* Voltz, p. 52, Pl. i, figs. 15a, b; *A. beyrichi* Oppel, p. 54, Pl. i, figs. 16-19.)
1868. PICTET, F.-J. 'Mélanges Paléontologiques. IV. Fossiles de la Porte-de-France,' (*A. latus* Voltz) p. 283, Pl. XLIII, figs. 1-4) and *A. imbricatus* Meyer (p. 285, Pl. XLIII, figs. 5-10) described from the Limestone of Porte-de-France.)
1870. ZITTEL, KARL A. 'Die Fauna der Aeltern Cephalopenführenden Tithonbildungen.' (*A. punctatus* Voltz (p. 31), *A. beyrichi* Oppel (p. 32), and *A. exsculptus* Schaubroth (p. 32, Pl. i, fig. 10) and Cellulose of the *latus* type (pp. 88, 89) described from the Tithonian of the Alps.)
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1891. RETOWSKI, O. 'Die Aptychen sind echte Ammonitendeckel.' Neues Jahrb., Jahrgang 1891, II, pp. 220-221 and text figure. (Description and illustration of *A. beyrichi* Oppel shown *in situ* in the aperture of *Haploceras elimatum* (Oppel).)
1893. RETOWSKI, O. 'Die tithonischen Ablagerungen von Theodosia.' Bull. Soc. Imp. des Nat. Mosc., N. S., VII, pp. 206-301, Pls. ix-xiv. (*A. punctatus* Voltz reported to be very abundant in Tithonian of Theodosia in the Crimea (p. 225); *A. beyrichi* Oppel described as *A. climati* because found *in situ* in *Haploceras elimatum* (p. 226); *A. cf. exsculptus* Schau- roth rare, p. 227, Pl. ix, fig. 2.)
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FIVE NEW SPECIES OF SALIENTIA FROM SOUTH AMERICA

BY G. K. NOBLE

Among the collections of amphibians from South America which have been acquired in recent years by The American Museum of Natural History, there are included several interesting new forms. Perhaps the most remarkable of these is one which must be referred to the genus *Sminthillus*, although zoogeographic considerations make it seem highly probable that the form described below has been derived from a different stock from that which gave rise to *S. limbatus*, the type, and, until this time, sole member of the genus. *S. limbatus* is confined to Cuba while the species described here is restricted to a limited region in southern Peru. *Sminthillus* has been only recently defined (Barbour and Noble, 1920, Bull. Mus. Comp. Zool., LXIII, p. 402). I have more recently added certain details in regard to the structure of the shoulder girdle (Noble, in press). These structural details are very important from a phylogenetic viewpoint. But, as I have discussed these features at considerable length in the latter paper, I shall not enter into them here.

The genus *Atelopus* is much in need of revision. A number of diverse stocks have been lumped together under the name *A. ignescens*. Until the limits of specific variability have been determined for several more forms, it is impossible to discuss the status of these stocks or the relations of a number of the described species. The characters which I have utilized below appear at this time to be diagnostic.

***Sminthillus peruvianus*, new species**

DIAGNOSIS.—Readily distinguished from the *S. limbatus* by its blunter snout, less vertical loreal region, by the presence of a tarsal tubercle, longer tibia and different coloration; from the disk-less species of *Syrhopus*, it may be distinguished externally by the more vertical loreal region and stouter form.

RANGE.—Known only from the present series secured near Juliaca, Peru, by H. H. Keays, (no date).

TYPE.—A. M. N. H. No. 14526; from the same locality.

DESCRIPTION OF TYPE.—Snout rounded, equal to the greatest diameter of the orbit; loreal region abrupt, nearly vertical; nostril midway between the tip of the snout and the anterior corner of the eye; interorbital space a little broader than the upper eyelid; horizontal diameter of the tympanum about one-half, vertical diameter nearly

two-thirds the greatest width of the eye; tympanum about one-half its smallest diameter from the latter. Digits pointed, no terminal disks; a well-developed tarsal and two metatarsal tubercles. Tibio-tarsal articulation reaching just beyond the posterior angle of the eye; when the limbs are held vertical to the axis of the body, the tibio-tarsal articulation overlapping its mate of the opposite side. Skin feebly granular above, smooth below.

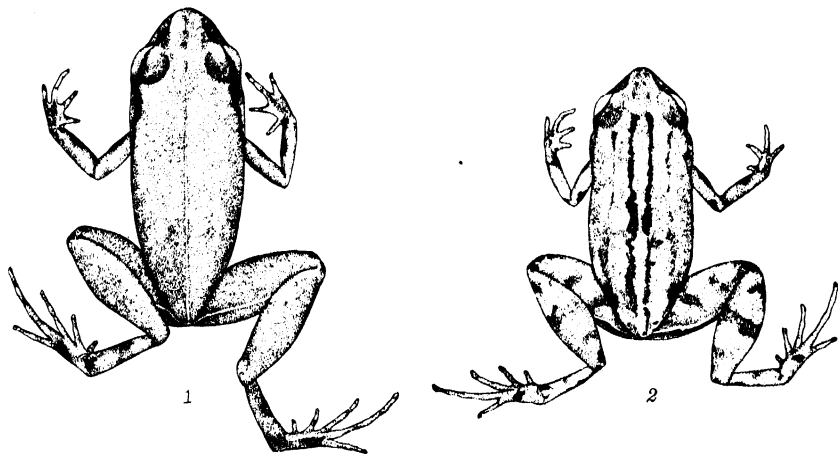


Fig. 1. *Smynthillus peruvianus*, new species. Type.

Fig. 2. *Smynthillus peruvianus*, new species. Paratype, showing color variation.

Color uniform grayish brown, slightly purplish above; a broad band of dark brown extending on each side from the nostril to the lumbar region; a narrow white line on the posterior face of each thigh joining with a median line which extends anteriorly along the back for more than half its length; posterior surfaces of the lower leg indistinctly barred with dark brown. Lower surfaces of body whitish, the chin and thigh indistinctly suffused with brown.

Dimensions

Snout to vent.....	16 mm.
Greatest width of head.....	5 mm.
Axilla to tip of longest digit.....	8 mm.
Groin to tip of longest toe.....	21.5 mm.

NOTES ON PARATYPES.—Four specimens in addition to the type are included in the series. These differ greatly in color and slightly in proportions. The two extreme types of coloration are shown in Figures 1 and 2. In the paratype figured, the ground tone is a pale yellowish brown. A sharply defined pattern is formed by blotches of dark brown. The two inguinal spots are nearly black. The ventral surface is uniformly suffused with a reddish brown which is darker on the throat than on the thighs. The other three paratypes exhibit stages of intergradation between the coloration of the paratype figured and that of the type specimen. Their browns are

redder than in the type and one has a broad hour-glass shaped pattern of dark reddish brown dorsally. The paratypes exhibit some variation in leg length. In all, the hind limb is longer than in the type.

Atelopus bicolor, new species

DIAGNOSIS.—A large species, closely allied to *A. boulengeri* Peracca, but differing in the webless digits of the manus and the shorter webs of the toes, also in the different proportions, shorter leg and shorter snout. Skin smooth; first toe distinct; tibio-tarsal articulation not reaching eye; generally dark brown above, yellow below, irregularly marked on the sides.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 13132; from Cordillera Kutuku (1800–2000 meters), east of Macas, Ecuador; collected by E. Feyer; 1921.

DESCRIPTION OF TYPE (Adult male).—Head a trifle wider than long, its length (tip of snout to angle of jaw) contained three and a half times in head and body length; distance from the eye to the end of the snout one-third greater than the longest diameter of the eye; nostril much nearer the end of the snout than the eye; snout projecting only a little beyond mouth; interorbital space 1.3 or 1.2 times the width of the upper eyelid. Anterior limb stout; distance from axilla to tip of longest digit equals the body length; no webbing between the digits of the manus although the skin between the first and second digits is thick; first digit much shorter than the fourth. Tibio-tarsal articulation nearly reaching the eye; toes webbed to the tips (except the fourth), but the web deeply indented, making the toes appear half webbed; a single metatarsal tubercle; subarticular tubercles feeble. Skin smooth above and below; a number of feeble transverse furrows on the ventral surface.

Color above dark reddish brown; below and on the sides yellow; an irregular dark streak on the sides of the abdomen; yellow of the sides encroaching upon the periphery of the dorsal ground tone, forming a symmetrical yellow margin to the dorsal coloration; limbs broadly crossbarred with yellow; ventral surface of the head and body immaculate; a few dark crossbars on the legs.

Dimensions

Snout to vent.....	51 mm.
Greatest width of head.....	15.5 mm.
Axilla to tip of longest digit.....	37 mm.
Groin to tip of longest toe.....	68 mm.

NOTES ON PARATYPES.—Three specimens in addition to the male were collected. Two are males and the third is an immature specimen. They vary considerably in coloration but agree in having the ventral surface yellow and immaculate, the dorsal surface dark brown or reddish with no markings except an irregular border of yellow.

Atelopus rugulosus, new species

DIAGNOSIS.—Very similar to *A. tricolor* Boulenger, from which it differs in the warty upper surfaces, somewhat different proportions and absence of "flash colors." Inner toe rudimentary; tibio-tarsal articulation extending beyond the eye; inter-orbital space twice as broad as the upper eyelid.

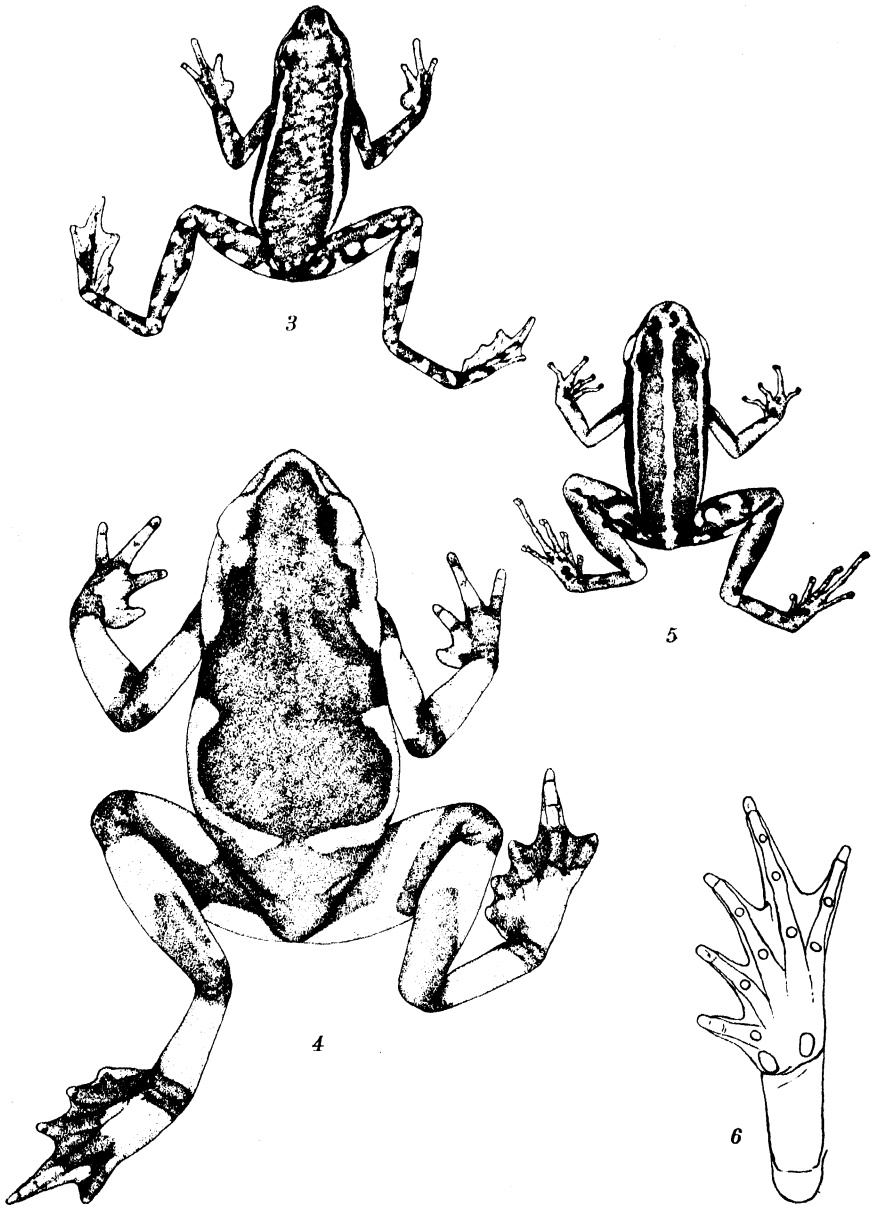


Fig. 3. *Atelopus rugulosus*, new species. Type.

Fig. 4. *Atelopus bicolor*, new species. Type.

Fig. 5. *Phyllobates anthonyi*, new species. Type.

Fig. 6. *Telmatobius cinereus*, new species. Type. Ventral surface of left foot.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 6097; vicinity of Juliaca, Peru; H. H. Keays.

DESCRIPTION OF TYPE (Adult male).—Distance from the angle of the jaw to the tip of snout one-fifth wider than the greatest width of the head, exactly three times as great as the head and body length; snout prominent, overhanging the mouth for a distance equal to the greatest diameter of the eye; nostril nearer the tip of the snout than the eye; interorbital space twice as broad as the upper eyelid. Fingers webbed slightly at the base, first very short; toes entirely webbed, but the web between the third and fourth, and the fourth and fifth digits notched; first toe rudimentary, enclosed within the web; no metatarsal or subarticular tubercles. Tibio-tarsal articulation reaches nearer the tip of the snout than the eye. Skin covered with flat warts above, smooth below, except for the throat which is somewhat granular.

Dark brown above spotted with yellow, a broad streak of yellow on each side of the back from eye to groin; upper lip yellow, and a series of yellow spots on the sides of the body; ventral surfaces yellow with a few dark spots on the belly; a tinge of pink on the thighs near their proximal end, but no axillary or inguinal spots of the same color.

Dimensions

Snout to vent.....	22 mm.
Greatest width of head.....	6.8 mm.
Axilla to tip of longest digit.....	14.5 mm.
Groin to tip of longest toe.....	30 mm.

NOTES ON PARATYPE.—Only two specimens, both males, of this species were secured. The paratype differs from the type in being more spinose, the tubercles being pointed, not flat as in the type. The coloration is essentially the same in both specimens, but the paratype is nearly immaculate below.

Phyllobates anthonyi,¹ new species

DIAGNOSIS.—Similar to *P. tricolor* (Boulenger), but readily distinguishable by its longer leg, longer first finger, longer snout, and different coloration. The color pattern is somewhat similar to that of *P. tricolor* but the flash colors are lacking and the stripes are bluish not yellowish.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 13739; from a small stream at Salvias, Prov. del Oro, Ecuador; collected August 10, 1920, by H. E. Anthony.

DESCRIPTION OF TYPE.—Snout depressed, a little longer than the greatest diameter of the eye; nostril much nearer the end of the snout than the eye; loreal region vertical; interorbital space 1.4 times as broad as the upper eyelid; tympanum a little more than half as long as the greatest diameter of the eye, edged above by a prominent supratympanic fold. Disks of the digits small, much smaller than the tympanum; first finger slightly longer than the second; two metatarsal tubercles, the inner prominent; a well-developed tarsal tubercle; tibio-tarsal articulation reaching the anterior corner of the eye. Skin smooth above and on the sides.

¹Named for Mr. H. E. Anthony, Associate Curator of Mammals of the Western Hemisphere in The American Museum of Natural History, and collector of the type series.

Ground tone above dark chestnut brown; a broad medial stripe and two dorso-lateral ones of pale bluish gray, the medial stripe widening anteriorly to form the major coloration of the snout, and restricting the ground tone in this region to a number of spots. Ground tone of the sides a little darker than that of the back; in addition to the dorsolateral stripe, a ventrolateral one of the same color; the latter forming anteriorly a prominent stripe on the upper lip, while the former passes along the outer edge of the eyelid and merges into the light tone of the snout. Thighs cross-barred with pale gray; concealed portion of the thigh blotched with white which may have been yellowish in life. Ventral surface white or slightly tinged with yellow and heavily marbled with dark brown, the marbling most pronounced about the periphery of the ventral surface; no dark bands on the chest or throat.

Dimensions

Snout to vent.....	21 mm.
Greatest width of the head.....	6.5 mm.
Axilla to tip of longest digit.....	14 mm.
Groin to tip of longest toe.....	30 mm.

NOTES ON PARATYPE.—A single paratype was secured. It differs from the type in having the lateral stripes more whitish and in having the ventral surface marbled with brown on the periphery only.

Telmatobius cinereus, new species

DIAGNOSIS. —Very similar to *T. niger* Barbour and Noble, from which it differs chiefly in the narrower webbing of the toes (compare Figure 6 with Fig. 1, Barbour and Noble, 1920, Bull. Mus. Comp. Zool., LXIII, p. 414), the narrower interorbital space, the absence of a ventral disk, and the grayish, not chestnut, coloration.

RANGE.—Known only from Bestion, Ecuador, the type locality.

TYPE.—A. M. N. H. No. 13968; from Bestion, Ecuador, caught in a mouse-trap set among low bushes and grass; January 7, 1921, by H. E. Anthony.

DESCRIPTION OF TYPE.—Size moderate; head much broader than long, narrower than the body, its length contained in the total length of the body a trifle more than three times; snout very short and high without canthus rostralis; nostril nearer the orbit than the labial border. Vomerine teeth prominent in two well-defined groups between the choanae; tongue about as long as broad. Interorbital space exactly as long as the diameter of the eye; length of the snout 1.4 times that of the eye; tympanum hidden; a prominent supratympanic fold. Digits free, stout, not dilated at the tips, the first finger longer than the second, a trifle longer than the fourth; the elbow extended forward reaches nearly to the eye. Toes a trifle less than half webbed, but narrow seams extending to the bases of the terminal phalanges; a well-defined tarsal fold; subarticular tubercles well developed; two metatarsal tubercles of about the same size; heels just in contact when the hind limbs are folded at right angles to the axis of the body; tibio-tarsal articulation reaching to the middle of the orbit or slightly beyond. Skin very glandular above, but not warty; no baggy lateral fold; a few irregular folds on each side of the body; no ventral disk, the skin of the abdomen not marked off from the lateral regions; a slight indication of a pectoral fold formed by a small fold on each side immediately posterior to the humerus; posterior surfaces of the thighs not folded or baggy.

Color above lead gray; ventral surface pinkish, heavily blotched and mottled with dark brown, the spots most abundant on the throat, least on the thighs.

Dimensions

Tip of snout to vent.....	62	mm.
Tip of snout to angle of jaw.....	20	mm.
Greatest width of head.....	24.5	mm.
Axilla to tip of longest digit.....	36	mm.
Groin to tip of longest toe.....	88	mm.

The species is known only from the type specimen. As might be expected from its distribution, the species is intermediate between *T. niger* Barbour and Noble and *T. ignavus* Barbour and Noble, but more closely related to the former.

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THE DISTRIBUTION OF THE SWALLOWS OF THE GENUS
PYGOCHELIDON

BY FRANK M. CHAPMAN

Continued study of our recently acquired collections of South American birds reveals certain facts in regard to the distribution of the blue and white swallows of the genus *Pygochelidon* which seem worthy of independent record.

The range of this genus extends from Costa Rica to Tierra del Fuego. It contains four known forms (of which two are herein described for the first time), the general characteristics and distribution of which are set forth below, following which I present some remarks and conclusions.

I am indebted to Dr. Alexander Wetmore, of the Biological Survey, and Mr. James L. Peters, of the Museum of Comparative Zoology, for information in regard to the distribution of *P. cyanoleuca* and *P. patagonica patagonica* based on their recent explorations in southern South America

***Pygochelidon cyanoleuca* (Vieillot)**

Hirundo cyanoleuca VIEILLOT, 1817, *Nouv. Dict. d'Hist. Nat.*, XIV, p. 509 (Paraguay. One Paraguay specimen examined).

Hirundo minuta MAX., 1821, 'Reise Bras.', II, p. 336 (Rio Janeiro, Brazil. Types and freshly collected material examined).

H[irundo] melampyga LICHT., 1823, 'Verz. Doubl.', p. 57 (Bahia, Brazil. Bahia specimen examined).

Atticora cyanoleuca var. *montana* BAIRD, 1865, 'Rev. Am. Bds.', p. 310 (Barranca, Costa Rica. Costa Rica specimens examined).

SPECIFIC CHARACTERS.—Sexes alike in color, tail in the male averaging longer. Adult with rectrices and remiges and their shafts, black or blackish; outer margin of outer rectrix never lighter than the rest of the feather; under wing-coverts and axillars fuscous to chatura-drab; lower tail-coverts wholly black with steel-blue reflections; median area of the feathers of the nuchal region whitish (a character more pronounced in northern than in southern specimens); underparts (except sides and flanks) pure white; back varying from a deep indigo-blue to a greenish blue, the variation partly individual, partly seasonal and apparently occurring throughout the range of the species. For example, a Boruca, Costa Rica, male taken May 10 is blue while a San José male taken April 1 is green. Both blue and green birds were

taken at San Antonio, western Colombia, in January; while of nineteen Bolivian tableland birds twelve, taken in May, June, and July, are green and seven, taken in November, December, and February, are blue.

Immature birds have the wings and tail fuscous, the lower tail-coverts dusky, more or less tipped with grayish, a trace of cinnamon may suffuse the white underparts, but the lower wing-coverts are as in the adult and the outer tail-feather is uniformly colored, the outer margin NEVER being paler than the rest of the feather.

SIZE.—There appears to be no marked latitudinal variation in size among birds from apparently the same altitude. Specimens from near sea-level in Ecuador (Rio de Oro) are the smallest in the series while specimens from the Ecuadorian tableland are larger and near the average size. The tail apparently averages longer in the male, but there is much variation in this respect.

Although recorded from Costa Rica to Paraguay¹ and from western Ecuador to eastern Brazil, *Pygochelidon cyanoleuca* is a bird of the Subtropical, rather than the Tropical, Zone and is restricted largely to mountainous regions. In Costa Rica, Carriker does not record it from a lower altitude than 1000 feet, whence it ranges upward to the Irazu district. It is recorded by Bangs from Chiriqui, western Panama, at an altitude of 10,800 feet, and from "Veragua" by Salvin and Godman. Sharpe and Wyatt ('Mon. Hirund.') state that Salvin and Godman's collection contains three specimens secured by McLeannan in "Panama," presumably south of Colon where this collector worked. There are no Panama specimens in the American Museum, and I know of no other Panama records. In Colombia we found this swallow to be most abundant in the Subtropical Zone, but it ranged from 2000 to 9000 feet. In Ecuador our only record for the coastal region is Rio de Oro, Manaví, whence it ranges upward to the tableland. It has not been found in the Guayaquil region and our most southern Pacific coast region record is Portovelo (alt. 2500 ft.), near Zaruma on the eastern slope of the coast range west of Santa Rosa. It occurs also in eastern Ecuador at Zamora and thence south on eastern, or Amazonian, drainage from Peru (Huanacabamba, Perico, La Merced, Perené, Sta. Ana, Torontoy, Santo Domingo) to Bolivia, whence all our specimens are from altitudes of from 7700 to 9400 feet (Depts. Cochabamba, Sucre). In Argentina it extends at least to the Prov. of Tucuman, whence we have a wholly typical adult male taken on the Tafi trail at an altitude of 2000 feet, April 12, 1916.

East of the Andes this swallow appears to be much less common. It is not, for example, recorded from the Orinoco region by Berlepsch

¹Records from Chile are evidently based on erroneous identification or wrongly labeled specimens. For example, a skin labeled by Rusby "Valparaiso" (doubtless the one referred to by Ridgway in Bull. 50, III, p. 70; see also Allen, 1889, Bull. A. M. N. H., II, p. 80) evidently bears an incorrect locality, as unfortunately do some other specimens in this collection.

and Hartert, or from Cayenne by Berlepsch, and Snethlage gives no definite record from Amazonia, though a specimen from Pará is listed in the British Museum 'Catalogue.' Salvin records it in Guiana only from an altitude of 3500 feet on Mt. Roraima, and a single Guiana specimen is listed from Camacusa. In Venezuela and Brazil it appears to be confined largely to the mountainous and coastal areas. It is apparently not uncommon near the coast of extreme southeastern Brazil, and Wetmore secured specimens at Lazcano, in northeastern Uruguay, the most southern record for the species.

From the interior of South America there appear to be only two records for this species. Smith secured one specimen September 10, 1885, at Chapada, Matto Grosso, during nearly five years' collecting, and a specimen in the U. S. National Museum, No. 35040, was secured by C. Wood of the Page Expedition at Bahia Negra, S. lat. 20° on the Paraguay River, in June, 1859.

Cherrie secured no specimens of this species during two expeditions in southwestern Brazil, and it is evidently rare or wanting in the interior of South America, at least north of subtropical latitudes.

In general, then, *Pygochelidon cyanoleuca* is not, as has been often stated, distributed "throughout" South America, but is largely confined to mountainous areas and to the Subtropical Zone. Furthermore, while not a bird of the forest, it occurs chiefly in forested regions.

***Pygochelidon patagonica patagonica* (d'Orbigny and Lafresnaye)**

Hirundo patagonica D'ORBIGNY AND LAFRESNAYE, 1837, 'Syn. Av.,' p. 69 (Patagonia).

Atticora hemipygga BURMEISTER, 1861, 'Reis. La Plata,' II, p. 479 (Mendoza, Argentina; one specimen examined).

SPECIFIC CHARACTERS.—Sexes alike in color (and in size?); rectrices and remiges and greater wing-coverts fuscous, their shafts brownish; outer margin of outer rectrix narrowly but distinctly EDGED WITH WHITISH; under wing-coverts and axillars mouse-gray; shorter lower tail-coverts white, longer ones sometimes (in more southern specimens) basally white; feathers of the nuchal region basally gray; size larger than *cyanoleuca*.

Immature birds have the wings and tail fuscous as in the adult. The under wing-coverts and axillars are also mouse-gray and the outer margin of the outer tail-feathers is edged with grayish. The longer tail-coverts are fuscous, tipped with grayish, the shorter ones white in young birds from Mendoza and Prov. Tucuman (4000 ft.), but in three specimens in a corresponding state of plumage from Tilcara (8000 ft.), Prov. Jujuy (February 8-12), the longer lower tail-coverts are fuscous tipped with cinnamon, the shorter ones cinnamon. I do not know whether this char-

acter represents a racial or individual variation. An adult female taken February 8, at the same locality, has the under tail-coverts wholly black. In other respects all four Tilcara birds are typical *patagonica*.

This is a migratory species. During the summer it is found throughout the South Temperate Zone, south to Tierra del Fuego and north to Peru over the Andes of northwestern Argentina and (presumably) Puna or Temperate Zone in Peru. It winters chiefly north of S. lat. 30° and (presumably) at the eastern base of the Andes as far north as the Marañon.

On the Pacific coast this swallow is doubtless found from Chiloe to near the Peruvian border where it apparently intergrades with the Peruvian race described below. I have, however, seen specimens only from Temuco to Tofo, sixty miles north of Coquimbo, but it is probable that the birds recorded by Lane¹ from east of Iquique should be referred to this race. According to this writer the species ranges upward to 12,000 feet, in which event it doubtless crosses the Andes at this, or even a greater, altitude.

It is found in southern Chile, and doubtless at high altitudes, only during the summer. I have been unable to ascertain the exact limits of its seasonal range in Chile but according to Barros² it is found in the Valley of Nilahue (S. lat. 34° 30') only from the end of August to the middle of March. In Argentina it is rarely found in winter south of the latitude of Buenos Aires and Mendoza.³ On September 10, 1916, I observed it in large numbers near the first-named city, where Dr. Dabbene informed me it had just arrived from the north. The return (postbreeding) migration is concluded by March 15.

Hartert,⁴ in recording the breeding of this swallow in the Prov. of Tucuman (no altitude stated) on the authority of Venturi, mentions also specimens from Cosnipata, Yurimaguas, and Nauta, Peru. Hellmayr⁵ also refers to the Cosnipata birds, of which one is young and four adult, and confirms Hartert's identification of them. They were collected by H. Whitely, Jr., on September 20, October 5 and 7, 1868, after the date, therefore, on which *patagonica* reaches its breeding grounds south of the latitude of Buenos Aires, and are consequently not likely to have been winter visitants from the South Temperate Zone.

¹1897, *Ibis*, p. 15.

²1920, *Revista Chilena Hist. Nat.*, XXIV, p. 147.

³Reed, 1916, 'Las Aves de la Prov. de Mendoza,' *Mus. Ed. Mendoza*, p. 39.

⁴1909, *Nov. Zool.*, XVI, p. 169.

⁵1919, *Arch. für Naturg.*, p. 9.

In traveling from Paucartambo to Cosnipata, Whitely passed over bare treeless regions at an altitude of 11,900 feet. We have seen that *patagonica* reaches an altitude of 12,000 feet on northern Chile and it would not be surprising if, like many other South Temperate Zone birds, it should range north on the Andean Temperate, or Puna Zone, whence, assuming that the specimens in question actually came from Cosnipata (alt. about 2350 ft.), it might occasionally visit the lowlands.

I frankly confess that the records from Yurimaguas and Nauta seemed to me to require confirmation. Both localities are in the Tropical Zone and the latter is some 250 miles east of the Andes, but the discovery in our own collection of a wholly typical adult male in fresh (postnuptial ?) plumage taken November 12, 1919, by H. Watkins at La Merced (alt. 2600 ft.) in the Chanchamayo district of eastern Peru, proves to my complete satisfaction that *patagonica* occurs in this region. I cannot, however, believe that a species so characteristic of the South Temperate Zone breeds in the Tropical Zone and, in spite of the fact that it has never been recorded from the Peruvian highlands, I conclude that records from Cosnipata, La Merced, Yurimaguas, and Nauta are based on birds which breed in the Temperate or Puna Zones and migrate or wander to the lowlands.

So far as I am aware no other swallow of the Temperate or Puna Zone has this habit, but no other swallow of these zones is found also in the South Temperate Zone. Possibly *patagonica* in extending its range northward on the Andean tableland has retained the migratory habit which it displays in the South Temperate Zone.

RELATIONS of *P. patagonica* with *P. cyanoleuca*

Having described the characters which distinguish *cyanoleuca* and *patagonica* from each other and outlined their known ranges the question arises, are they specifically or subspecifically related? In other words, do they or do they not intergrade? While I have no proof that both forms are actually found together during the breeding season, it is evident that in Uruguay, Paraguay, and northern Argentina the limits of their ranges very closely approach, if they do not actually touch, each other.¹ It is also a fact that throughout its wide range *cyanoleuca* shows no appreciable geographic or racial variation, specimens from Uruguay,

¹Until we know the facts in regard to the seasonal distribution of *patagonica* in Peru, we cannot discuss its relationships with *cyanoleuca* in that region.

Paraguay, and northern Argentina, where the species most closely approaches the home of *patagonica*, agreeing with others from Colombia or Costa Rica.

It is further true that, except for a racial differentiation on the coast of Peru and certain variations exhibited by four specimens from Tilcara (8000 ft.) near Tucuman, *patagonica* is everywhere true to type. The Peruvian variation will be returned to later; the Tilcara birds require description here. They were taken February 8-12, 1916. An adult female in worn breeding plumage has the tail, wings, and under wing-coverts wholly black as in *cyanoleuca*. The remaining three specimens are birds of the year in postjuvenile plumage. Like the adult female, their wings, under wing-coverts, and tail are as in *patagonica*, but the longer under tail-coverts are fuscous tipped with cinnamon, while the shorter ones are cinnamon, a character shown by no immature specimen of *cyanoleuca* which I have examined. While the adult specimen might be considered an intermediate between *cyanoleuca* and *patagonica*, the young birds could not properly be so considered. Moreover, an adult and young taken March 12, 1916, above San Pablo (4000 ft.), Prov. Tucuman, are wholly typical of *patagonica*, the young bird having the lower half of the under tail-coverts white. While, therefore, we have an ultratypical adult of *cyanoleuca* taken on the Tafi trail (2000 ft.), Prov. Tucuman, April 12, 1916, it is improbable that intergrades between this species and *cyanoleuca* would be found at the highest of the three localities mentioned.

If those from the intermediate locality were intergrades, the fusion of the two species might be indicated in this region. Under the circumstances, however, I conclude that the variations shown by the Tilcara specimens are either individual or racial, and that they do not indicate the intergradation of *cyanoleuca* with *patagonica*.

It is worthy of note that the variation shown by the west Peruvian bird, described below, is similar to that exhibited by the Tilcara adult, that is, it has wholly black under tail-coverts. In the paleness of the under wing-coverts the Peruvian form is even further removed from *cyanoleuca* than is *patagonica*, and, as shown beyond, it is quite certain that it does not intergrade with that form.

Further evidence of the stability of the characters of *patagonica*, east of the Andes, is shown by the fact that a specimen from La Merced, eastern Peru, agrees closely with others from Argentina.

In view of these facts, I conclude that *cyanoleuca* and *patagonica* do not intergrade and hence are specifically distinct.

***Pygochelidon patagonica peruviana*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Pygochelidon patagonica patagonica* but smaller, the under wing-coverts and axillars paler; the under tail-coverts wholly black with bluish reflections, the lower parts, particularly flanks, tinged with grayish.

TYPE.—No. 152,289, Amer. Mus. Nat. Hist.; ♀ ad.; December 26, 1918; Huaral, Prov. Lima, Peru; H. Watkins.

The *Pygochelidon* of western Peru has heretofore been referred to *cyanoleuca* but proves to be a northern representative of *Pygochelidon patagonica*. Our collection contains forty-four specimens of this race taken from Moquegua in southern Peru, north to Trujillo. Specimens from Arequipa, listed in the 'Catalogue of Birds of the British Museum' under "*Atticora cyanoleuca*," are probably to be referred to this form, but it apparently does not reach the tableland. Although our Peruvian collector, H. Watkins, has sent us specimens of this swallow from nearly every station from Trujillo to Moquegua, it is not included in his large collections from the Payta region and the Peruvian-Ecuadorian boundary. This fact, in connection with Stolzmann's¹ definite statement that the species does not occur at Tumbes, and its absence from Noble's² collections made from Payta eastward, indicates that it is not found in extreme northwestern Peru.

RELATIONS OF *P. p. peruviana* WITH *P. cyanoleuca*.—The possession by *peruviana* of the wholly black under tail-coverts of *cyanoleuca* and the wings and tail of *patagonica* might be accepted as evidence that it was a connectant between these two species. The fact, however, that in *peruviana* the under wing-coverts and axillars are even paler than they are in *patagonica*, shows that in this respect it is less like *cyanoleuca* than *patagonica* itself. Moreover, the probability that the range of *peruviana* does not reach that of *cyanoleuca* further indicates their non-intergradation.

RELATIONS OF *P. p. peruviana* WITH *P. p. patagonica*.—Although I have seen no specimens of either of these races from the region between Tofo, Chile, and Moquegua, Peru, just north of the Chilean line, the species has been recorded from east of Iquique and doubtless occurs at suitable localities between these two points, for example, Tacna and Arica. Tofo specimens are typical of *patagonica*; one from Moquegua is immature, but an adult female of *peruviana* from Cocachacra, on the coast south of Mollendo, shows an approach to *patagonica* in its larger

¹1884, 'Orn. Per.', I, p. 245. In view of Stolzmann's statement that this swallow was replaced at Tumbes by *Progne chalybea*, it is interesting to note that the only specimens of this martin sent us by Watkins are from localities in the Payta district where he did not take *P. p. peruviana*.

²1918, Auk, p. 458.

size (wing, 99 mm.) and the presence of white in the shorter under tail-coverts. The latter character is shown also by a specimen from Pisco, and these two birds indicate, in my opinion, the intergradation of *peruviana* with *patagonica*.

***Pygochelidon flavipes*, new species**

SPECIFIC CHARACTERS.—Resembling *Pygochelidon cyanoleuca* (Vieillot) but the feet yellow and smaller; the upperparts darker; sides and flanks blackish; throat cinnamon-buff, chin dusky.

TYPE.—No. 169,932, Amer. Mus. Nat. Hist.; ♀; April 7, 1921; Maraynioc, 10,850 ft., Prov. Junin, Peru; H. Watkins.

DESCRIPTION OF TYPE.—Upperparts shining, dusky slate-blue; wings and tail blacker, less blue; throat cinnamon-buff, this color tinging the breast, chin dusky; under wing-coverts, axillars, flanks and tibiae fuscous-black; under tail-coverts like wings; tarsi wholly bare, with toes and nails buffy yellow. Wing, 92; tail, 47; tarsus, 9; middle toe without claw, 6.5; depth of tail-fork, 11 mm.

This species differs so widely from any specimens in our large collections of allied forms that I venture to describe it on the basis of but one example. It is apparently an Andean Temperate Zone representative of *Pygochelidon cyanoleuca* and the fact that it comes from Maraynioc, in the humid Temperate Zone of the Eastern Andes of Peru, is a further proof that exceptionally potent forces have prevailed in the zone in which that locality is situated.

The bird's evident relationships with *P. cyanoleuca* make it of interest to note that, like that species, of which specimens were secured only 3000 feet farther down the Valley, it inhabits a wooded region.

If, as seems probable, *P. p. patagonica* occurs at this or a higher altitude in Peru, it doubtless will be found on the treeless areas of the arid Temperate or Puna Zones.

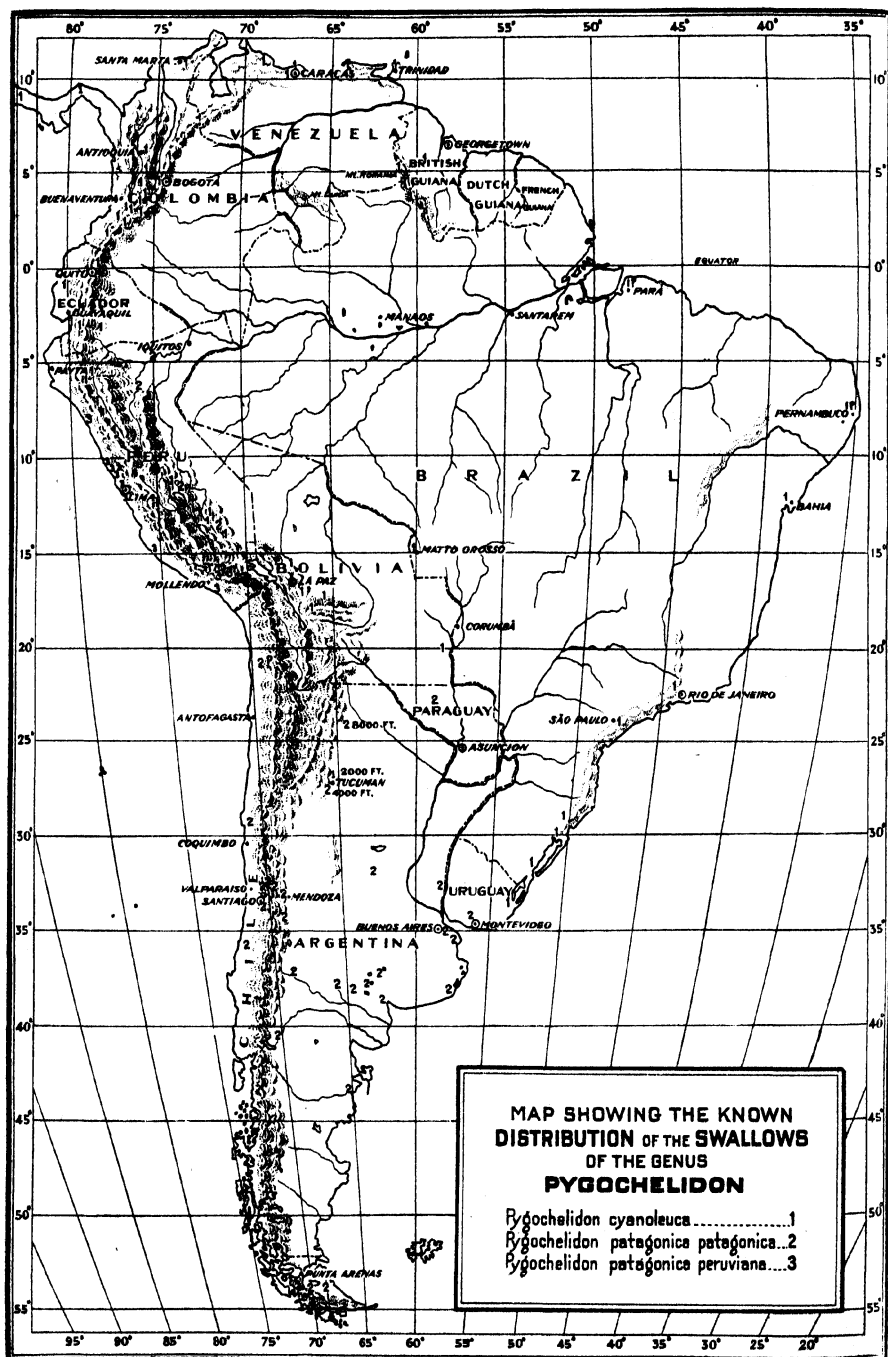
From Maraynioc have been described such distinct generic types as *Doliornis sclateri*, *Xenodacnis parina*, *Pseudospingus xanthophthalmus*, and *Microspingus trifasciatus*, besides a number of species and races all as yet unknown outside the humid Temperate Zone in Peru.

MEASUREMENTS OF MALES

	NUMBER	WING	TAIL
<i>P. cyanoleuca</i> , Costa Rica, Irazu, 9000 ft.	2	95-96.5	51-51.5
" " Colombia, Caldas, 2000 ft.	1	94	45
" " " Popayan, 6000 ft.	1	98	50
" " " Gallera, 5700 ft.	1	97	51
" " Venezuela, Barsiquimeto	1	91	42
" " Ecuador, Rio de Oro, sea-level	3	86-90	43-45.5
" " " Quito region, 8-9000 ft.	3	97-98	48-51
" " " Portovelo, 2500 ft.	1	94	47
" " Peru, Perené, 2000 ft.	1	95	44
" " " Utcuyacu, above Perené, 4800 ft.	2	98-102	49-53
" " Bolivia, Prov. Cochabamba, 7700-9400 ft.	5	98-103	50-53
" " Brazil, Matto Grosso,	1	98.5	50
" " Argentina, Tafi Trail, 2000 ft.	1	94	46
<i>P. p. patagonica</i> , Argentina, Mar del Plata	1	101	52
" " " Chile, Temuco	1	101	51
" " " " Los Andes	1	101	51
" " " " Tofo, sea-level	2	101-101.5	50-52
<i>P. p. peruviana</i> , Peru, Huaral, sea-level	3	96-97	49.5-52
" " " " Lima	2	95.5-96	51-53

MEASUREMENTS OF FEMALES

	NUMBER	WING	TAIL
<i>P. cyanoleuca</i> , Costa Rica, Turrialba, 3700 ft.	1	90	45
" " Colombia, Caldas, 2000 ft.	1	97	48
" " " San Antonio, 6800 ft.	1	96	48
" " " La Palma, 5500 ft.	1	95	47
" " Ecuador, Portovelo	1	90	45
" " Peru, Ft. Machu Picchu, 5000 ft.	1	96	46.5
" " " Santo Domingo, 6000 ft.	2	91-95.5	44.5-45
" " Brazil, Therezopolis, 3200 ft.		94	47
" " Bolivia, Prov. Cochabamba, 8800 ft.	1	99	48
<i>P. p. patagonica</i> , Argentina, Tilcara, Jujuy, 8000 ft.	1	101	52
" " " Chile, Tofo, sea-level	2	101.5-104.5	50
<i>P. p. peruviana</i> , Peru, Huaral	2	93	49
" " " " Vitarte	2	93-94	49
" " " " Huacho	1	94	49



SPECIMENS EXAMINED

Pygochelidon cyanoleuca.—COSTA RICA: San José, 1; Boruca, 2; Irazú, 2; Turrialba, 1. COLOMBIA: Caldas, 4; San Antonio, 2; Popayan, 2; Gallera, 2; Ricuarte, 1; Salento, 2; El Eden, 2; Rio Toché, 2; Sta. Elena, 2; La Palma, 1; El Carmen (near Bogotá), 1. VENEZUELA: Barsiquemeto, 2; Mérida region, 1; Caracas, 2; Guácharo, 2. BRAZIL: Therezopolis, 1; Rio region, 2; Chapada, Matto Grosso, 1. ECUADOR: Rio de Oro, Prov. Manaví, 3; 'Quito' skins, 7; Mocha, 1; Portovelo, 2; Zamora, 1. PERU: Chilpes, Prov. Junin, 1; Tulumayo, Prov. Junin, 2; Utcuyacu, Prov. Junin, 2; La Merced, 1; Perené, 2; Sta. Ana, 1; Ft. Machu Picchu, 1; Torontoy, 1; Santo Domingo, 10. BOLIVIA: Prov. Cochabamba, Incachaca, 7; Parotani, 5; Vinto, 2; Prov. Sucre, Pulque, 4; Rio Pilcomayo, 1; Rio Cachimayo, 1; California, Prov. Santa Cruz, 1. ARGENTINA: Tafi Trail, Prov. Tucuman, 2000 ft., 1, April 12. PARAGUAY: Bahia Negro, 1. URUGUAY: Lazcano, Dept. Rocha, February 7, 8 (Wetmore).

Pygochelidon patagonica patagonica.—PARAGUAY: 200 km. west of Puerto Pinasco, September 24 (Wetmore). ARGENTINA: above San Pablo, 4000 ft., Prov. Tucuman, 2, March 12; Tilcara, 8000 ft., Prov. Jujuy, 4, February 8-12; Mar del Plata, 1, October 19; Mendoza, 1, November; Zapala, Neuquen, December 8, 1920 (Wetmore); General Roca, Rio Negro, November 27, 1920 (Wetmore); N. W. Rio Negro, breeding (Peters); Tunyan, Prov. Mendoza (Peters); Protrerillos, 5000 ft., Prov. Mendoza (Peters); Protrerillos, 5000 ft., Prov. Mendoza, March 19, 1921 (Wetmore); Carhué, Buenos Aires, December 18, 1920 (Wetmore); Guamini, Buenos Aires, March 5, 7, 1921 (Wetmore). CHILE: Temuco, Cautin, 1, October; Los Andes, 2700 ft., 1, August; Tofo, 60 miles north of Coquimbo, 4, December 3-24.

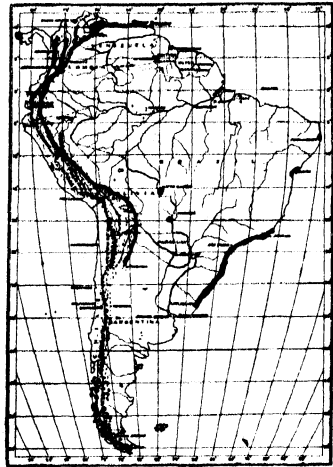
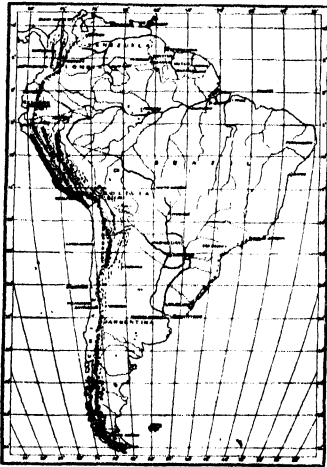
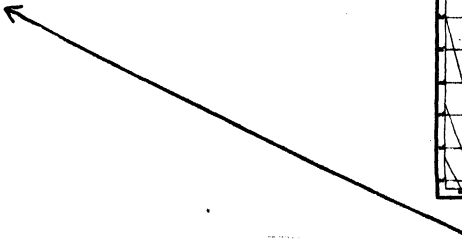
Pygochelidon patagonica peruviana.—PERU: Moquega, 1; Coca-chacra, 1; Vitor, 1; Pisco, 1; Lima, 3; Chorillos, 1; Vitarte, 6; Huacho, 7; Bequeta, 3; Huaral, 14; Trujillo, 6.

Pygochelidon flavipes.—PERU: Maraynioc, the type.

GENERAL REMARKS AND CONCLUSIONS

From the preceding studies it appears that the west Peruvian form, of a group distributed from Costa Rica to Tierra del Fuego, was derived not from the north, as might be expected, but from the south. The geographical origin of the group must remain as much a matter of speculation as its ancestry. The extent and geological history of the area it

inhabits, however, indicates that *cyanoleuca* is the older of the two species composing it. This species has been shown to be chiefly mountain-inhabiting, its range being subtropical rather than tropical. If now we look for an ancestral form inhabiting the tropics we find nothing nearer to *cyanoleuca* than *Diplochelidon melanoleuca*, which differs from it

1 *P. cyanoleuca*3 *P. patagonica peruviana*2 *P. patagonica patagonica*

in the more complete adherence of the basal phalanx of the middle toe to the outer toe, its more deeply forked tail, and bluish black breast-band. The fact, however, that, without regard to locality, specimens of *cyanoleuca* often have partially black feathers in the breast, suggest that this is a vestigial character, a matter of possible significance in this connection.

However this may be, the obvious distinctness of *cyanoleuca* suggests the probability of its development in the older mountain areas of Guiana or Brazil; whence, following the coastal mountains, it, on the one hand, reached the Venezuelan Andes and, on the other, subtropical latitudes to the south.

Once in the Andean region, it found suitable conditions for range extension in the practically unbroken expanse of the Subtropical Zone, stretching from Venezuela to Bolivia but, although it has reached the Pacific coast just south of the equator, the northward extension of the Temperate Zone on the coast of Peru, under the influence of the Humboldt Current, checked its progress on the coast south of Ecuador. Furthermore, since *cyanoleuca* is found in the vicinity of forests, and probably nests in holes in trees, the absence of wooded areas on the coast of Peru would discourage it from entering that region.

Through the mountains of Panama it reached Costa Rica. It appears to be uncommon in the Isthmus at present, a fact readily to be accounted for by the subsidence which has created a hiatus in the ranges of many species common to the Subtropical Zone of Colombia and Panama, but which are wanting in the intervening area.¹

From the theoretical point of origin in the mountains of eastern South America, the range of *cyanoleuca* extends southward to subtropical latitudes in Uruguay, Paraguay, and northern Argentina. Here it meets the northern limit in this region of the range of *patagonica*, with which species it is not known to intergrade. The ranges of the two birds apparently do not overlap, but one replaces the other and they may, therefore, be regarded as representative species.

The question now arises: assuming that *cyanoleuca* is the older of the two, is *patagonica* an offshoot of it or were they derived from a common ancestor?

The fact that their ranges join but that the birds do not intergrade indicates that *patagonica* is not a geographic derivative of *cyanoleuca*

¹A list of these species is given in the author's paper on the 'Distribution of Bird-Life in Colombia, 1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 158.

but that both forms had acquired their distinguishing characteristics before they came into contact with each other.

Aside from these suggestions, further discussion of their origin involves a more exact knowledge of past physiographic and climatic conditions in South America than we at present possess.

Granted, however, that *patagonica* had a northern ancestor, we may follow its extension of range southward until it reached the ends of the continent. Once well within the South Temperate Zone, its further southward distribution must have occurred only during the warmer part of the year, and with the coming of winter it evidently retreated toward the north where it now remains at the junction of the South Temperate and Subtropical Zones until returning spring permits it to revisit its breeding ground. Thus has been developed the habit of migration.

It is natural to assume that the Pacific coast was reached from Argentina. Thence, west of the Andes, for the facts all indicate the birds' appearance on the Peruvian coast since the elevation of these mountains, it extended its range toward the equator following that arm of the Temperate Zone which, under the influence of the Humboldt Current, passes up the coast to the vicinity of Trujillo, the most northern point at which this swallow is known to occur. Here the counteracting forces of a cold current on the one hand and the approach to equatorial regions on the other, produce what may be termed a Subtemperate Zone, where conditions differ sufficiently from those prevailing farther south to bring about the development of numbers of new forms and our swallow now becomes smaller and presents slight but constant color characters which distinguish it from true *patagonica*, the parent form.

The case is an especially interesting one to compare with that of *cyanoleuca* and *patagonica* as outlined above. Although in both instances the differentiating characters are slight, in one we have contact of range without intergradation, in the other apparently gradual merging of one form into its representative race.

North of Trujillo the effects of a warm, southward flowing, inshore current begin to be apparent, and this vicinity marks the northern known limit on the coast of Peru of Humboldt's Penguin (*Spheniscus humboldti*) and the Diving Petrel (*Pelecanoides garnoti*) the ranges of which extend northward, as Murphy¹ has shown, to 7°, and 6° 21' south latitude respectively.

¹1920, Brooklyn Museum Quarterly, p. 91.

This study, therefore, shows that, when due consideration is given to relationships and their bearings on geographic as well as physical origin, and to those factors which determine climatic and hence faunal conditions, it is not surprising that the form of *Pygochelidon* inhabiting the coast of Peru was derived from the south instead of from the north.

POSTSCRIPT.—In reply to an inquiry, Mr. Harry Watkins, our collector in Peru, writes from Lima that he saw no swallows at any of his several stations in the coastal region of Peru north of Trujillo. His experience in regard to these birds agrees, therefore, with that of Stolzmann at Tumbes, as quoted above.

DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM COLOMBIA, ECUADOR, AND ARGENTINA

BY FRANK M. CHAPMAN

The following descriptions of apparently new South American birds are chiefly by-products incident to the preparation of a report on the distribution of bird-life in Ecuador. I have to thank Dr. Percy R. Lowe of the Bird Department of the British Museum, Mr. Outram Bangs of the Museum of Comparative Zoology, and Dr. E. W. Nelson of the Biological Survey, for the loan of specimens or for permission to examine the collections under their care.

Zenaida auriculata caucæ, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Zenaida auriculata auriculata* (Des Murs) but size slightly smaller, the tail more graduated, its central feathers more pointed, the lower tail-coverts usually more or less vinaceous.

TYPE.—No. 109,386, Amer. Mus. Nat. Hist.; ♂ ad.; Cali, Colombia; August 11, 1911; Richardson and Miller.

SPECIMENS EXAMINED

Zenaida auriculata caucæ.—COLOMBIA: Cali, 3 ♂, 1 ♀; Palmira, 1.

Zenaida auriculata auriculata.—CHILE: Temuco, 1 ♂, 1 ♀; Tofo, 2 ♂.

Zenaida auriculata hypoleuca.—"Pearl Island," the type (in Brit. Mus.). ECUADOR and PERU, a large series.

On two former occasions,¹ I have called attention to the resemblance between specimens of *Zenaida auriculata* from Chile and the Cauca Valley, but the uncertainty in regard to the proper disposition of Bonaparte's name *Zenaida hypoleuca* has discouraged an attempt to determine the true status of the Colombian bird.

Examination of Bonaparte's type in the British Museum shows it to be a specimen of the form for which Bangs and Noble proposed the name *Zenaida auriculata pallens* and, in satisfactorily disposing of this question, shows also that the Colombian form is unnamed. I have therefore characterized it as above.

Its characters appear to present an exceptionally interesting case of parallelism. Briefly stated, the case, so far as it relates to specimens from the Pacific coast region, is as follows. The type form, *auriculata auricu-*

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 206; 1921, Bull. U. S. Nat. Mus., 117, p. 47.

lata, occupies Chile from at least Temuco to Tofo, sixty miles north of Coquimbo. It is characterized chiefly by its almost uniform vinaceous underparts, the abdomen as well as the breast being of this color. In Peru and Ecuador this form is replaced by one in which the abdominal region is cream-buff, with the under tail-coverts paler than in the Chilean bird. In the Cauca Valley of Colombia, however, a return is made to the characters of the Chilean bird, the bird of that region having the abdomen vinaceous, as in true *auriculata*, and indeed differing from that race but slightly in size and color. The difference in the graduation of the tail is marked and diagnostic.

MEASUREMENTS

	Sex	Wing	Tail	Extent of Tail Graduation
Cali, Cauca, Colombia	♂	139	86	23
" " "	♂	143	85	25
" " "	♂	135	88	31
Temuco, Chile	♂	152	90	14
Tofo, Chile	♂	158	92	16
" " "	♂	151	90	20
Cali, Colombia	♀	133	79	21
Palmira, Colombia	♀	135	75	24
Temuco, Chile	♀	138	75	17

***Oreopelia bourcieri subgrisea*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Oreopelia bourcieri bourcieri* (Bonap.), but underparts as in *O. frenata*, the breast pale drab-gray instead of cinnamon-drab or drab; center of abdomen slightly paler than breast, pale smoke-gray rather than drab as in most specimens of *bourcieri*; lower tail-coverts grayer.

TYPE.—No. 150,984, Amer. Mus. Nat. Hist.; ♂ ad.; Alamor, 4350 ft., Prov. Loja, Ecuador; July 10, 1919; H. Watkins.

SPECIMENS EXAMINED

Oreopelia bourcieri subgrisea.—ECUADOR: Alamor, 2 ♂ (inc. type), 1 ♀; Celica, Prov. Loja, 1 ♂.

Oreopelia bourcieri bourcieri.—COLOMBIA: 3 ♂, 8 ♀. ECUADOR: Rio Zamora, 1 ♂, 4 ♀; Zaruma, 5 ♂, 8 ♀, 2 ?.

Oreopelia frenata.—BOLIVIA: Vermejo, Prov. Santa Cruz, 1 ♂; Yungas, Prov. Cochabamba, 1 ♂.

This proposed new form is obviously an intermediate between *Oreopelia frenata* and *O. bourcieri*, its discovery indicating the intergradation of these two forms. In the color of underparts it agrees exactly with a male from Vermejo, Bolivia, while above it as closely resembles true *bourcieri*. Comparison of the type of *Oreopelia bourcieri baeza*

Chubb¹ with true *bourcieri* convinces me that it is not separable from that species, an opinion which is supported by the fact that five specimens from the Rio Zamora, in eastern Ecuador, are unquestionably typical *bourcieri*.

Specimens from Zaruma in southwestern Ecuador, north of Alamor, are intermediate between *bourcieri* and *subgrisea* and clearly demonstrate the intergradation of these two races.

***Jacana scapularis*, new species**

SPECIFIC CHARACTERS.—Similar to *Jacana jacana jacana* (Linn.), but black of the anterior parts of the body less sharply defined from the back and extending backwards for an inch or more on the scapulars; light area of the two outer primaries white in both adults and young, untinged with greenish; chestnut areas averaging paler; size, averaging larger. ♀: Wing, 134; tail, 40; tarsus, 55; culmen, 31. ♂: Wing, 136; tail, 40; tarsus, 55; culmen, 32.

TYPE.—No. 119,626, Amer. Mus. Nat. Hist.; ♂ ad.; Chone, Prov. Manaví, Ecuador; December 16, 1912; W. B. Richardson.

SPECIMENS EXAMINED

Jacana scapularis.—ECUADOR: Chone, 1 ♂ ad., 2 ♂ juv., 1 ♀ ad.; Puna Is., 1 ♀ ad.; 'Quito,' 1 ad.²

Jacana jacana jacana.—BRAZIL, BOLIVIA, northern ARGENTINA, and PARAGUAY, a large series of adults and young.

Jacana jacana intermedia.—VENEZUELA: Sacupuna, 1 ♂ ad., 2 ♂ ad.; Estado Lara, 1 ad. COLOMBIA: La Morelia, 1 ♀.

So far as I am aware, no other form of *Jacana jacana* has been recorded from west of the Andes. In Colombia we found this species only at La Morelia³ in the Amazonian Fauna, while specimens from the Magdalena and Cauca Valleys are referable to *Jacana nigra*. The range of *scapularis* is therefore separated from that of *jacana* by the Andes—an impassable barrier—and this fact, in connection with its pronounced characters, indicates the specific distinctness of the west-Ecuador bird. In this connection it is also pertinent to note that the white outer primaries characterize the immature as well as the adult bird.

***Rupornis magnirostris zamoræ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Rupornis magnirostris magnirostris* (Gmel.) but darker, the upperparts deep neutral gray, the bars of the abdominal region and tibiae russet, the bordering gray bars darker and broader, sometimes largely

¹1917, Bull. Brit. Orn. Club, XXXVIII, p. 33 (Baeza, East Ecuador).

²This specimen, from the Lawrence Collection, is a trade skin. It, of course, did not come from Quito, but its black scapulars and white outer primaries indicate that it did come from Ecuador.

³Recorded by me (1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 225) as *Jacana spinosa* but, following Ridgway's treatment of this group, should evidently be known as *Jacana jacana intermedia* Sci.

replacing the russet bar lying between them; bars on tibiae of the same color as those on abdomen; tail, upper tail-coverts, and under wing-coverts without trace of ochraceous or cinnamon-rufous.

TYPE.—No. 166,708, Amer. Mus. Nat. Hist.; ♀ ad.; Sabanilla, alt. 5700 ft., Rio Zamora, Prov. Loja, Ecuador; November 9, 1920; George K. Cherrie.

SPECIMENS EXAMINED

Rupornis magnirostris zamora.—ECUADOR: Sabanilla, 1 (the type); Zamora, 2. COLOMBIA: La Palma, 5700 ft., Huila, 1.

Rupornis magnirostris magnirostris.—SURINAM: Vicinity of Paramaribo, 9; Wannaweg, 1. VENEZUELA: Sacupana, Lower Orinoco, 1; La Union, Maripa, Lower Orinoco, 1; R. Caura, 2; Cumanacoa, Bermudez, 1. COLOMBIA: Barrigon, 2; Villavicencio, 3; Honda, 3; Chicoral, 2; Sta. Elena, 1; Barro Blanco, 1; Atrato River, 1; Puerto Valdivia, 1; Dabeiba, 1; Bonda, Sta. Marta, 3¹; Sta. Marta, 1.¹

The form here described exhibits the distinguishing characters which one would expect to find in a bird inhabiting the humid forests of the Amazonia slope of the Ecuadorian Andes. Its occurrence at La Palma, near the head of the Magdalena Valley, further emphasizes the Amazonian affinities of the avifauna of that locality, where we have already found *Piaya cayana mesura* and *Tangara cyaneicollis caeruleocephala*.²

Ciccaba æquatorialis, new species

SPECIFIC CHARACTERS.—Resembling *Ciccaba albigularis* but throat not white, crown barred instead of spotted, an evident buffy nuchal collar, outer webs of scapulars buffy, primaries barred on inner webs; abdominal region whiter.

TYPE.—No. 35,591, Amer. Mus. Nat. Hist.; "Ambato" (probably East Andean slope below Los Baños), Ecuador; M. A. Vascombez.

SPECIMENS EXAMINED

Ciccaba æquatorialis.—ECUADOR: the type.

Ciccaba albigularis.—COLOMBIA: Choachi (proposed type-locality, see Chapman, Bull. Amer. Mus. Nat. Hist., XXXVI, 1917, p. 254); 4; Bogotá, 1; Sta. Elena, Antioquia, 1 ♀; Medellín, 1. VENEZUELA: Escorial, near Mérida, 1 ♂, 1 ♀; Culata, near Mérida, 1 ♂, 1 ♀. ECUADOR: no locality, 2.

DESCRIPTION OF TYPE.—General color above dark cinnamon-brown with buffy and ochraceous markings; band from the base of bill to back of eye white slightly stained with ochraceous; whole top of head finely barred with ochraceous-tawny; a narrow nuchal band largely ochraceous-buff; auriculars ochraceous-tawny barred with black; postauricular region ochraceous-buff barred with blackish; back slightly lighter than crown, the ochraceous-tawny bars wider; outer web of most of the scapulars white tinged with buff, and terminally margined with blackish; tail brownish fuscous barred and, laterally and terminally, marbled with ochraceous-buff or ochraceous-tawny; wing-quills like the tail, their outer webs with broadly con-

¹*Rupornis magnirostris insidiatrix* Bangs and Penard.

²1917, See Bull. Amer. Mus. Nat. Hist., XXXVI, pp. 321, 598.

spicuous ochraceous-buff bars which, on the secondaries, have dusky centers; inner webs of all the quills with rather poorly defined but evident ochraceous-buff bars; wing-coverts like the back barred and mottled with ochraceous-buff and ochraceous-tawny; throat and chest ochraceous-tawny finely barred with black; breast and flanks whitish with blackish shaft-streaks, mottlings, fine broken bars and ochraceous-buff bases; lower tail-coverts and tibiae ochraceous-buff, the center of the abdomen paler. Wing, 197; tail, 98; tarsus, 24; culmen, 21 mm.

The single specimen on which this species is based has remained unidentified for years in the Museum collection in the hope of the receipt of additional material. My work on the birds of Ecuador necessitating the determination of its status, the conclusions reached are presented herewith.

In the pattern of coloration of the scapulars this species resembles *Otus nudipes*, but the resemblance ends there, the tarsus in *aequatorialis* being feathered as in *Ciccaba*, while the upperparts are finely barred instead of spotted with ochraceous-tawny; nor can I detect ear-tufts in the Ecuador bird.

The specimen on which this species is based was part of a collection containing examples of *Osculatia sapphirina*, *Pionites melanocephalus pallidus*, and other species characteristic of the eastern slope of the Andes, from which region the collection doubtless reached Ambato through Los Baños.

***Glaucidium brasilianum tucumanum*, new subspecies**

SUBSPECIFIC CHARACTERS.—Resembling the black and white-barred tail phase of *Glaucidium brasilianum brasilianum* but upperparts, wings and streaks below fuscous with (in one specimen) a barely perceptible tinge of brown; the crown with small, inconspicuous whitish spots or shaft-streaks; broken nuchal band, white; back with practically no white markings. ♂: Wing, 90; tail, 65; tarsus, 16 mm. ♀: Wing, 95; tail, 65; tarsus, 16 mm.

TYPE.—No. 140,625, Amer. Mus. Nat. Hist.; ♂; Rosario de Lerma, 4800 ft.; Prov. Salta, Argentina; January 10, 1916; Miller and Boyle.

SPECIMENS EXAMINED

Glaucidium brasilianum tucumanum.—ARGENTINA: Rosario de Lerma, 1 ♂, 2 ♀.

Glaucidium nanum.—CHILE: Tierra del Fuego, 1 ♂; Punta Arenas, 1 ♂, 1 ♀; Temuco, 1 ♂, 3 ♀; Valparaiso, 1; Rio Blanco, 1 ♂; Tofo, 60 m. north of Coquimbo, 1 ♀. PERU: Moquegua,¹ Prov. of Moquegua, 1 ♀.

Glaucidium brasilianum brasilianum.—ARGENTINA: La Valle, Santiago del Estero, 1 ♂, gray phase, 1 ♂, int. phase, 1 ♀, int. phase; Suncho Corral, Santiago

¹This specimen considerably extends the known range of this species. It is in the grayish brown phase of color with a blackish tail barred with ochraceous-tawny. The tail, however, is tipped with white and the intervening blackish areas are twice as wide as the tawny bars. The spots on the crown are larger and more numerous than in our other specimens, and the bird may represent a northern form of *nanum*. It measures: Wing, 196; tail, 78 mm.

del Estero, 1 ♂, gray phase. BRAZIL: Urucum near Corumbá, 1 ♂, rufous phase, 2 ♀, gray phase; Descalvaldos, Matto Grosso, 1 ♂, rufous phase; Chapada, Matto Grosso, 1 ♀, rufous phase, 1 ♀, int. phase, 3 ♀, gray phase; eastern Brazil, 3 rufous phase (including two types of *ferruginea* Wied); Ceará, 1 gray phase, 1 rufous phase; Boa Vista, Maranhão, 1 ♀, gray phase. PERU: Ollantaytambo, Urubamba Valley, 1 ♂, gray phase; Pacific coast region, 15, both sexes and phases. Western ECUADOR: 25, both sexes and phases.

Glaucidium brasilianum phalaenoides.—TRINIDAD and Caribbean coast region of VENEZUELA and COLOMBIA, 24, both sexes and phases.

While I have no doubt of the distinctness of the form here described, I do not know whether it should be accorded specific or subspecific rank. The three specimens on which it is based are as nearly alike in color and markings as three specimens of this group can well be and are not to be matched in the large series of other forms examined. The type has a tinge of cinnamon on some of the white areas of the central tail-feathers and the crown markings are minute spots rather than shaft-streaks. All the specimens were taken on January 10 and are in full molt; the incoming plumage resembles in color that which it is replacing.

The four specimens from Santiago del Estero are apparently typical of *brasilianum*, though I have not enough eastern Brazilian material to determine this point satisfactorily. Two of these birds are in gray plumage with thickly spotted crowns and more or less white in the back and bear no close resemblance to the form here described. Five "gray" birds from Chapada and Urucum, Matto Grosso, on the other hand, agree with the Rosario de Lerma specimen in the restriction of the crown markings and lack of white on the back, but they are very much browner above than the sooty-fuscous *tucumanum*. Possibly the absence of crown-markings may be attributed to immaturity, since at least two of these Matto Grosso birds are not fully adult.

With *Glaucidium nanum* also recorded from the Tucuman¹ region, it is clear that much work remains to be done before we have a thorough knowledge of the distribution and relationships of the forms of this genus occurring in northwestern Argentina.

***Grallaricula flavirostris ochraceiventris*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Grallaricula flavirostris costaricensis* LAWL., but wing longer, bill stouter and averaging longer; ochraceous of underparts more extensive, wholly, or in part covering the abdomen. Differing from *Grallaricula flavirostris flavirostris* Scl. in its more olive upperparts, more intense color of the

¹See Dabbene, 1910, Ann. Mus. Nat. Buenos Aires, III, part 11, p. 255.

ochraceous areas; comparatively unstreaked breast and ochraceous abdomen. ♂: Wing, 68; tail, 24.5; tarsus, 21; exposed culmen, 15 mm. ♀: Wing, 67; tail, 25; tarsus, 23; exposed culmen, 15.5 mm.

TYPE.—No. 109,636, Amer. Mus. Nat. Hist.; ♂ ad.; Cocal, alt. 4000 ft., Western Andes, Colombia; June 13, 1911; W. B. Richardson.

***Grallaricula flavirostris zarumæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Grallaricula flavirostris ochraceiventris* but all the ochraceous areas yellower, less orange-ochraceous; that of the forehead, loreal and ocular region less pronounced, the auriculars more olivaceous; black ante-orbital crescent stronger; maxilla yellow or olive-yellow, rather than dark brown. Differing from *Grallaricula flavirostris flavirostris* Scl. in having the back light brownish olive rather than Dresden-brown; the breast practically unstreaked; the abdomen ochraceous; the maxilla yellower. ♂: Wing, 65; tail, 25; tarsus, 23; exposed culmen, 15 mm. ♀: Wing, 65; tail, 25; tarsus, 22; exposed culmen, 14.5.

TYPE.—No. 129,758, Amer. Mus. Nat. Hist.; near Zaruma, alt. 6000 ft., Prov. del Oro, Ecuador; October 5, 1913; W. B. Richardson.

SPECIMENS EXAMINED¹

Grallaricula flavirostris ochraceiventris.—COLOMBIA: Cocal, the type; San Antonio, 1 ♀.

Grallaricula flavirostris flavirostris.—ECUADOR: Napo, the type; Baeza, 1; Sarayacu, 2. COLOMBIA: Bogotá, 2; "Colombia," 2 (all in Brit. Mus.).

Grallaricula flavirostris costaricensis.—COSTA RICA: Buena Vista, 1; Sarapiquí, 1 ♀; "Costa Rica," 2. PANAMA: Veragua, 5; Chiriquí, 1 ♀ (type of *G. vegeta* Bangs).

Grallaricula flavirostris brevis.—PANAMA: Mt. Pirri, 2 ♂ (inc. type), 2 ♀.

Grallaricula flavirostris zarumæ.—ECUADOR: near Zaruma, 6000 ft., Prov. del Oro, 2 ♂ (inc. type); El Chiral, 5350 ft., Santa Rosa-Zaruma Trail, 3 ♂, 2 ♀.

Examination of the type and other specimens of *Grallaricula flavirostris flavirostris* Scl. in the British Museum enables me for the first time satisfactorily to determine our specimens of this group from the western Andes of Colombia and Ecuador. It appears that the west-Ecuador birds, which I had hitherto provisionally referred to the east-Ecuador form, are quite distinct from it. They not only have an even yellower bill but the black margins to the feathers of the breast are less pronounced than in any other race of the species, being in some specimens practically absent, while in true *flavirostris* they reach their maximum of development and are in strong contrast to the ochraceous or white portion of the feather on which they appear. Furthermore, *zarumæ*, agreeing with the other western races, has the upperparts

¹It should be stated that the specimens listed below were not all examined at the same time and direct comparison in every instance has, therefore, not always been possible. However, all this material has passed through my hands and a large part of it, including the types or topotypical specimens of every form, has been in my possession at the American Museum.

decidedly more olivaceous than *flavirostris*. The differences between the two may, in fact, prove to be specific rather than subspecific, when *flavirostris* would stand alone and the western forms would be ranked as races under the specific name of *costaricensis*. All, however, are obviously representative forms and their relationships seem most truly expressed by trinomials.

The species appears to be confined to the Subtropical Zone and the known distribution of its races is indicated by the list of localities at which specimens have been secured.

The genus has not been recorded from Peru, but is represented in Bolivia by the recently described *Grallaricula boliviana* Chapman,¹ a strongly marked species with a white chest space, the feathers of the throat as well as breast margined with black. The margins of the breast-feathers are broad, sharply defined, and usually enclose the arrow-shaped ochraceous area, producing the scaled effect which characterizes the breast of *Premnornis*.

¹1919, Proc. Biol. Soc. Wash., XXXII, p. 257.

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PRELIMINARY REPORT ON ECUADOREAN MAMMALS. No. 2

By H. E. ANTHONY

This is the second paper based upon the collection of Ecuadorean mammals made in 1920 and 1921.¹ The mammals of this expedition, some 1550 specimens, are being studied with the intention of publishing a detailed report at some future time. Additional material is being acquired in the meantime, since it is part of the plan to carry on systematic field work in this republic. Whenever new species come to light, preliminary reports, such as the present paper, will appear.

***Phyllotis fruticicolus*, new species**

TYPE.—No. 47674, Amer. Mus. Nat. Hist.; ♂; Guachanamá, southern Ecuador; altitude, 9050 ft.; October 9, 1920; collector, H. E. Anthony. The type is a skin and skull, the latter with the sutures of the parietal region opened, but the elements have not been lost.

GENERAL CHARACTERS.—Resembling *haggardi* superficially, but differing from it in the characters of longer tail, smaller ears, grayer appearance and shorter nasals.

DESCRIPTION.—

Color above a mixture of warm buff and blackish, the general effect being decidedly grayish, the blackish coming from the dark-colored bases of the hairs, the buff strongest along the sides and about the head; below, soiled white, the hairs slate-colored at base. Ears small for the genus, colored like back without any conspicuous areas of buff or black hairs; hands and feet white; tail bicolor to match body coloring.

Skull rather lightly built; nasals very short, with median depression; inter-orbital constriction greatest midway of frontals, margins smooth and unheaded.

MEASUREMENTS.—Taken in the flesh: total length, 193 mm.; tail vertebrae, 102; hind foot, 24. Greatest length of skull, 24.7 (25.3)²; length of nasals, 8.9 (10.3); zygomatic breadth, 12.4 (13.5); interorbital breadth, 3.9 (4.2); breadth of braincase, 11.8 (12.5); length of upper molar series, 4.2 (4).

The type of *fruticicolus* is a young adult, with the molar crowns showing only moderate wear, so it is possible that older specimens might show more highly colored pelage. In color the Guachanamá specimen may be closely matched by selected specimens from a large series of topotypical *haggardi*, but the new species is well characterized by the notice-

¹See 'Preliminary Report on Ecuadorean Mammals. No. 1,' by H. E. Anthony, American Museum Novitates, No. 20, November 3, 1921.

²Measurements in parentheses are those of No. 46835, *Phyllotis haggardi* from Mt. Pichincha, 12,000 ft. altitude.

ably shorter nasals and the longer tail. The ear of *fruticicolus* is smaller and less conspicuous than the ear of *haggardi*, although the series of the latter would appear to show that there is considerable individual variation in the size of the ear of *haggardi*.

The type is one of a series of three specimens, all collected at Guachanamá, on a rocky hillside overgrown with tough shrubbery.

*
***Microsciurus sabanillæ*, new species**

TYPE.—No. 60464, Amer. Mus. Nat. Hist.; ♀ ad.; Sabanilla, Prov. de Loja, Ecuador; altitude, 5700 feet; November 18, 1920; collector, H. E. Anthony. The type is a skin with skeleton.

GENERAL CHARACTERS.—A large species, apparently related to *avunculus*, practically unicolor above, with ochraceous underparts and lacking a postauricular spot.

DESCRIPTION.—

Color, above, between dark olive (Ridgway) and mummy brown, depending on how skin is held to the light; below, near ochraceous tawny; top of head lightly washed with ochraceous buff, but not conspicuously so; ears clothed interiorly with short hairs slightly darker in tone than the ochraceous buff of the crown; no postauricular patches; orbital ring scarcely discernible; forearms and hind limbs like back; hands like back, feet washed with same color as hairs on ears; tail, above, very similar to back, but hairs tipped with clay color, below noticeably darker than color of rest of underparts.

Skull large and characterized by long nasals and long palate, the latter extending considerably beyond plane of last molars posteriorly.

MEASUREMENTS.—Taken in the flesh: total length, 280 mm.; tail vertebra, 146; hind foot, (c.u.), 41. Skull, greatest length, 37.8; zygomatic breadth, 22.3; length of nasals, 11.7; interorbital breadth, 13.1; breadth of braincase, 19; length of palate, 16.5; length of upper molar series (exclusive of small pm.), 6.1.

In pattern of coloration *sabanillæ* comes logically within the group of species characterized by *similis*. The uniform coloration above, without any black dorsal region or crown and with no conspicuous white or buffy areas on or behind the ears, sufficiently distinguishes this new species from the other *Microsciurus* already known from the Oriente of Ecuador, *napi* and *avunculus*, and from other members of the genus outside of the *similis* group. It is much larger than any species related to *similis* and in this respect more nearly resembles *avunculus*. The type locality of *avunculus* is given as Gualaquiza, altitude 2500 feet, while *sabanillæ* was taken in forest at an elevation of 5700 feet, which fact may account for the seemingly strange occurrence of two distinct forms so close together, since Sabanilla is on the Rio Zamora not very far distant from Gualaquiza. Thomas,¹ in the type description of *avunculus*, com-

¹1914, Ann. Mag. Nat. Hist., (8) XIII, p. 574.

pare it to *napi* which in turn is "quite like *peruanus*." Lacking specimens of both *avunculus* and *napi*, I have turned to the type of *peruanus*, which I find to be very different from *sabanilla*, not only in the possession of white auricular patches but in cranial characters as well, since the new species has proportionally much longer nasals and longer palate.

***Marmosa perplexa*, new species**

TYPE.—No. 47188, Amer. Mus. Nat. Hist.; ♀ ad.; Punta Santa Ana, Prov. de Loja, Ecuador; altitude 3650 feet; December 21, 1920; collector, H. E. Anthony. The type is a skin and skull, the posterior part of the skull being broken. The type locality is on the trail from Zaruma to Loja and is in the interandean region, on Pacific drainage.

GENERAL CHARACTERS.—Of fairly large size, resembling a small specimen of *cinerea*, but with fur extending only a short distance onto base of tail; skull short and broad with noticeable frontal depression.

DESCRIPTION.—

Color above, Saccardo's umber (Ridgway), the hairs slaty at base; below, chamois, with light ochraceous-buff wash on pectoral region, everywhere the hairs slaty at base; orbital ring blackish, not very extensive; crown slightly lighter than dorsal region, hands and feet proximally dusky, distally soiled whitish; tail brownish above, noticeably lighter in color, faintly mottled with small, indistinct, blotches of white.

Skull rather short and broad, with heavy zygomata; a faintly developed supra-orbital bead but no supraorbital process; a marked depression in frontal area at nasal suture; first tooth of upper molar series well developed, second noticeably larger than third.

MEASUREMENTS.—Taken in the flesh: total length, 305 mm.; tail vertebrae, 178; hind foot, 22. Skull, zygomatic breadth, 19.4; least interorbital breadth, 6.2; nasals, 14×5; length of palate, to gnathion, 19; length upper toothrow, C-M⁴, 14.8; length M¹-M⁴, 7.7.

This murine opossum shows characters that would place its relationships with the *cinerea* group, were it not for the peculiarly depressed frontal region and the lack of a postorbital process, which condition is not noted in skulls of *cinerea*, *waterhousii* and *phaea*, the only species which *perplexa* appears to resemble. Skulls of *klagesi* from Venezuela show a little of the depressed frontal condition, but *klagesi* has nothing to do with *perplexa* in any other character. The material on hand for comparison is rather inadequate and consequently it is difficult to say with certainty to just what group this new species belongs.

***Marmosa oroensis*, new species**

TYPE.—No. 47180, Amer. Mus. Nat. Hist.; ♂ ad.; Portovelo, Prov. del Oro, Ecuador; altitude 2,000 feet; September 2, 1920; collector, H. E. Anthony. The type is a skin with skull.

GENERAL CHARACTERS.—A light-colored form, similar externally to *simonsi*, but with the smooth interorbital region of *fuscata* or *madescens*.

DESCRIPTION.—

Above, between drab and wood-brown, the hairs with slate-colored bases; below, ivory-yellow over entire throat and chest and medially to root of tail, the hairs unicolor to base; along sides of abdomen the light-colored hairs are slaty at base; orbital spot narrow but extending almost to end of nose, area between orbital spots above, slightly lighter in color than back; ears about like back in color; wrists and ankles dusky; hands and feet yellowish white; tail above, very similar to back in color, below distinctly lighter from base to tip.

Skull long and slender, with smooth interorbital region, no beading or postorbital processes.

MEASUREMENTS.—Taken in the flesh: total length, 294 mm.; tail vertebrae, 170; hind foot, 20. Skull, greatest length, 35.1; zygomatic breadth, 16.7; interorbital breadth, 6; nasals, 15.9×4 ; palate, to gnathion, 19.0; upper toothrow, C-M⁴, 13.8; length, M¹-M⁴, 6.7.

M. oroensis is somewhat like *simonsi* superficially, although it does not have quite as long pelage nor such light-colored feet and nose. Cranially the two forms have little in common since the skull of *simonsi* has marked postorbital processes. It is much lighter in color throughout than *madescens* although in cranial characters these two species are somewhat similar. It may well be that *oroensis* should stand as a subspecies of *sobrina* Thomas which is said to be related to *fuscata*. The Portovelo specimen is quite like *fuscata* in skull characters but differs from it sufficiently in external details to be distinct, while from *sobrina* it may be differentiated by the greater extent of the light-colored underparts and by the much lighter tone of the upperparts. Unfortunately, there are no available specimens of *sobrina* for actual comparison.

Apparently *oroensis* is the opossum of the semi-xerophytic tropical zone, for animals taken in the same general region but at higher elevation and in the forest are the related *celicæ*.¹

***Marmosa celicæ*, new species**

TYPE.—No. 47182, Amer. Mus. Nat. Hist.; ♂ ad.; Celica, Prov. de Loja, Ecuador; altitude, 6900 feet; September 28, 1920; collector, H. E. Anthony. The type is a skin with skull which is broken posteriorly.

GENERAL CHARACTERS.—Most like *sobrina* and *oroensis* but differing, from the former in having tail bicolor for its full length as well as in smaller size, from the latter in darker coloration and slightly different interorbital region.

DESCRIPTION.—

Color, above, near sepia with hairs slaty at base; below ivory-yellow medially, the widest area at chest, hairs unicolor to base, encroaching hairs of sides and flanks

¹See the following description.

light-tipped with slate-colored base; orbital rings extending almost to end of nose; area above included between orbital rings only slightly lighter in color than dorsal region; hands and feet dusky above, distally whitish; tail like back above, distinctly lighter below throughout entire length.

Skull like that of *oroensis* but having faint postorbital swellings of the frontal elements which appear to foreshadow postorbital processes.

MEASUREMENTS.—Taken in the flesh: total length, 278 mm.; tail vertebrae, 157; hind foot, 20. Skull, interorbital breadth across postorbital swellings, 6.8; least interorbital breadth, 5.8; nasals, 15.5×3.6; palate, to gnathion, 18.5; length upper toothrow, C-M⁴, 13.5; M¹-M⁴, 6.5.

M. celicæ is very closely related to *oroensis* but can be distinguished by its darker color above, its much more restricted yellow underparts and its swollen frontals. Skulls of two females show some of this swelling but not to the same degree as seen in the skull of the male (type). From *sobrina* this new form differs in having a distinctly bicolor tail as well as a somewhat smaller skull. The acquisition of more material is necessary to determine the degree of relationship between *celicæ* and *oroensis* which I suspect may prove to be subspecific, or perhaps both may be best treated as subspecies of *sobrina*.

M. celicæ was taken at Celica and Alamor near the Peruvian border and at Salvias, in the forest near the headwaters of the Rio Amarillo. The altitudinal range as established by these records is from 3500 feet to 6900 feet, all three localities in forest.

***Marmosa bombascaræ*, new species**

TYPE.—No. 47186, Amer. Mus. Nat. Hist.; ♀ ad.; Zamora (junction of Rio Bombascaro with Rio Zamora), Prov. de Loja, Ecuador; November 24, 1920; collector, H. E. Anthony. A skin in fair condition (eaten about tail and feet by ants while in trap), with skull.

GENERAL CHARACTERS.—Most like *musicola*, but larger and lacking postorbital processes on the supraorbital border, but with well-developed beading.

DESCRIPTION.—

Color above, intermediate between cinnamon and russet, the hairs slate-colored at base; below ochraceous buff, the hairs of the median area unicolor to the base, elsewhere slaty; orbital area black, small subtriangular area between orbital rings noticeably lighter than the rest of upperparts; hands dusky, feet soiled whitish; tail brownish, only slightly lighter below, no white tip.

Skull heavily built, with conspicuous supraorbital bead, wide flaring zygomatic and no postorbital process on the supraorbital border.

MEASUREMENTS.—Taken in the flesh: total length, 313 mm., tail vertebrae, 187, hind foot, 21. Skull, greatest length, 34.5; zygomatic breadth, 19.3; interorbital breadth, 6.5; nasals 15×4.3; length of palate, to gnathion, 19.2; length of upper toothrow, C-M⁴, 13.4; length, M¹-M⁴, 7.

M. bombascaræ appears to be closely related to *musicola* Osgood. Superficially it is best characterized by its soft, lax fur of moderate length, the strongly yellow underparts, and the tail without any white. The type skin, that of a female, has the inguinal area suffused with vinaceous as is also the case with a female of *musicola*. But for the differences in cranial characters, I should have made *bombascaræ* a subspecies of *musicola*. However, the skull of the new species is so distinct in size and the detailed structure of the interorbital area, that the relationship calls for full specific separation.

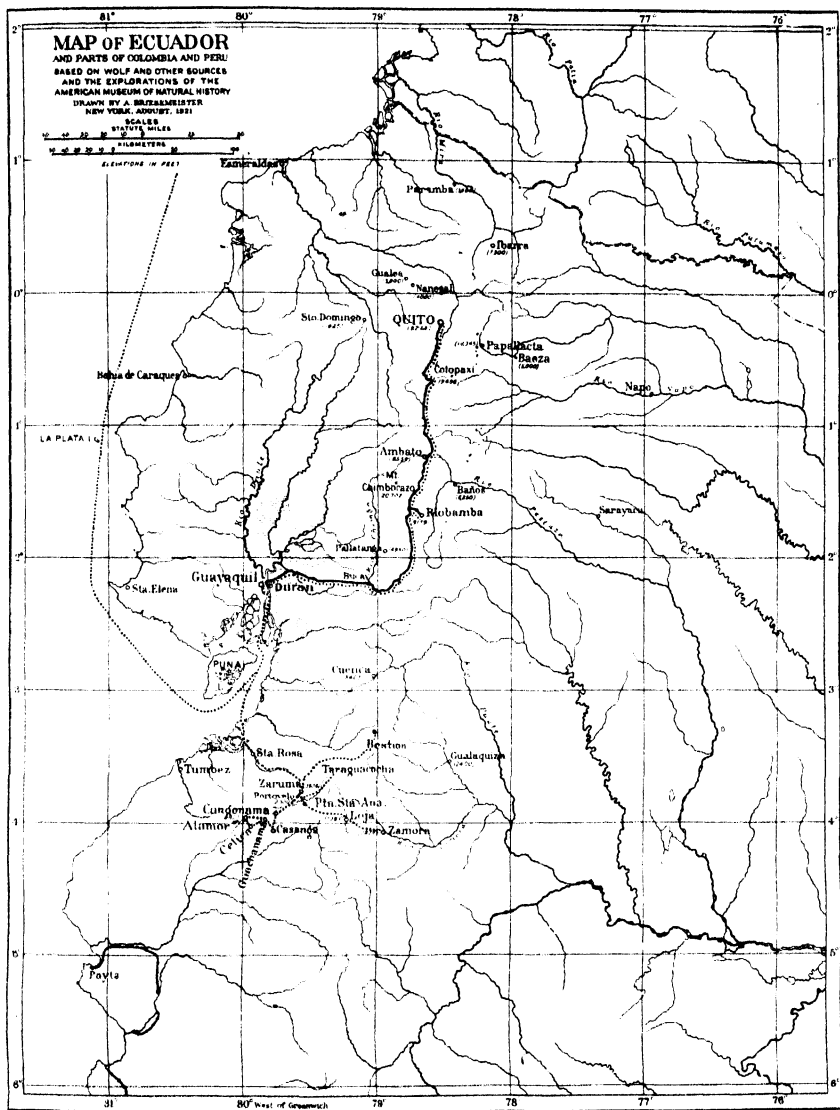


FIG. 1. Map to show route of the expedition to Ecuador, June 1920 to March 1921, indicated by dotted line. The principal collecting stations and type localities mentioned in this paper are also shown.

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BEES OF THE GENUS *PERDITA* FROM THE WESTERN STATES

By T. D. A. COCKERELL

The bees recorded below, with the exception of *Perdita wickhami*, were obtained by Dr. Frank E. Lutz and his associates during their exploration of the Western States for The American Museum of Natural History. They were collected by Dr. Lutz, except where the contrary is stated. The collection adds ten species and three races or varieties to the already long list of western *Perdita* and greatly extends our knowledge of distribution. The material of the *Cockerellia* group (*albipennis*, etc.; large forms, with stout, bent mandibles in the female) is particularly interesting and has suggested a discussion of the evolution of the species and races.

Perdita woottonæ Cockerell

COLORADO: 5 ♂, 4 ♀, Pueblo, vacant lots in town, August 9, 1920; 1 ♀, 2 ♀, La Junta, August 12, 1920, Mrs. F. E. Lutz, collector; 2 ♂, Wray, August 17-19, 1919; 1 ♂, Tennessee Pass, about 10,300 ft. alt., August 1, 1919, H. F. Schwarz, collector.

For the characters of this species, see 1907 Entomological News, XVIII, p. 57. The two Wray males differ greatly in the size of the head. The specimen labelled Tennessee Pass has an unusual amount of black pigment about the lateral ocelli, but the locality seems almost incredible, as the bee is an oligotropic visitor of *Nuttallia*, which is not likely to occur at such an altitude. Rydberg has recorded *N. speciosa* (Osterhout) from 10,000 ft., but this also seems improbable. It may be, however, that *Nuttallia* and *P. woottonæ* do occur at Tennessee Pass in a favorable exposure.

Perdita solitaria Cockerell

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mts., about 3800 ft. alt., August 15-21, 1916.

Described from New Mexico.

Perdita callicerata Cockerell

ARIZONA: 1 ♂, southwest end of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 4, 1916.

Described from New Mexico, where it visits *Baileya*.

***Perdita heliophila* Cockerell**

COLORADO: 2 ♀, 1 ♂, Mesa Verde National Park, about 6000 ft. alt., at *Helianthus petiolaris*, July 4, 1919.

Described from New Mexico (1916).

***Perdita albipennis* Cresson**

COLORADO: 6 ♀, 1 ♂, Wray, most of the females at *Helianthus*, August 17, 1919, one collected by Pearce Bailey, Jr.; 1 ♀, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 12 ♀, 10 ♂, La Junta, August 12, 1920, one ♀ collected by Mrs. Lutz, one ♂ from very arid hills, four of the males show yellow markings on the abdomen (var. *helianthi* Ckll.); 3 ♂, Glenwood Springs, at edge of town, July 22–29, 1919 and August 5, 1920, one collected by Mrs. Lutz is var. *helianthi*; 1 ♂, Pueblo, vacant lots in town, August 9, 1920; 1 ♂, Montrose, July 19, 1919, H. F. Schwarz, collector.

***Perdita pallidipennis indianensis*, new subspecies**

♂ (Type).—Clypeus and sides of face wholly without light markings; anterior tibiae without a pale stripe; margin of stigma and end of marginal cell fuscous.

♀.—Not appreciably differing from the typical form.

INDIANA: 1 ♀, 1 ♂, Lafayette, August 16, 1920.

The female is easily known from *albipennis* by the dark hair on outer side of hind tibiae, and the dark, rounded apical plate of abdomen. The species *P. pallidipennis* Grænicher was described from Wisconsin.

***Perdita verbesinæ* Cockerell**

ARIZONA: 1 ♂, Tucson, at *Helianthus*, August 14–17, 1916, collected by Mr. J. A. G. Rehn.

Compared with New Mexico specimens, it is more robust, with unusually large head; prothorax above flattened, with a pair of light stripes on hind border; mesothorax shining yellowish green, slightly coppery in middle.

***Perdita lacteipennis* Swenk and Cockerell**

COLORADO: 3 ♀, 4 ♂, Wray, August 17–19, 1919; 14 ♀, 10 ♂, Mesa Verde National Park, at *Helianthus petiolaris*, July 3–7, 1919; 1 ♂, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 4 ♂, La Junta, August 12, 1920; 1 ♀, Durango, at *Helianthus petiolaris*, July 2, 1919; 1 ♂ (abdomen marked with yellow, much as in var. *helianthi* of *albipennis*), Fruita, July 16, 1919. UTAH: 1 ♀, 1 ♂, Ogden, August 29, 30, 1916.

Females of *lacteipennis* from Ogden, Durango, Grand Junction, and the Mesa Verde National Park have the immaculate face of *Perdita canadensis* Crawford. A female *P. canadensis* collected by Professor Stevens at Sheldon, North Dakota, differs from these by the yellow

tubercles and very dark apical plate of abdomen. Crawford's description, however, indicates dark tubercles. Crawford notes that *canadensis* has the first recurrent nervure interstitial (or nearly so) with the transverse cubital, whereas in *lacteipennis* it enters the second submarginal cell some distance from the base. Our insects have the *lacteipennis* venation, but I observe that one of the Grand Junction females (though not the other) has the recurrent interstitial. The typical female *lacteipennis* has a pale vertical stripe or bar on the clypeus, but I have a cotype, from Niobrara, Nebraska, with the unmarked *canadensis* face and the *lacteipennis* venation. The Wray *lacteipennis* are typical. The males of *lacteipennis* vary in the size of the head and in the presence or absence of a yellow stripe on the scape. The original description cites a stripe on the scape, but a cotype lacks it. In four Wray males, it is present on two. Other sets of males vary similarly in the stripe.

I can only conclude that *canadensis* is a form of *lacteipennis* which occurs northward as a distinct subspecies (see Grænicier, 1914, Canadian Entomologist, XLVI, p. 52) and is represented in western Colorado and Utah by an insect which is neither pure *canadensis* nor typical *lacteipennis*. As *lacteipennis* varies in Nebraska to the dark-faced (♀) condition, it seems impossible to recognize two species.

The question next arises, whether *lacteipennis*, *canadensis*, and *heliophila* may not all be reduced to races of *albipennis*. At La Junta, males which could only be referred to *lacteipennis* occurred along with *albipennis* males. The only females to go with them were six in which the vertical light bar on the clypeus was very distinct, but the lower margin of the clypeus, instead of being pale right across, presented only lateral spots, these sometimes obsolete. One or two of these specimens could be referred readily enough to *lacteipennis*, but they certainly are all one thing, and others must be called *albipennis*. Indeed, Cresson's original description of *albipennis* (clypeus with a longitudinal yellow line down middle and a transverse yellow spot on each side) indicates just such an insect, and the more highly colored examples which seem best to typify the species (biologically speaking) are marked as is described for var. *lingualis* Ckll.

Swenk has investigated this matter in Nebraska and concludes that *lacteipennis* is a valid species, because it and *albipennis* occur together "and are yet perfectly distinguishable," while *albipennis* occurs alone in eastern Nebraska. In a similar manner, *albipennis* abounds in New Mexico, where it is not accompanied by *lacteipennis*; in southern New Mexico the *helianthi* form is the only one and hence assumes the char-

acter of a distinct race. Strictly speaking, typical *albipennis* (from the standpoint of nomenclature) is the insect of southeastern Colorado and northern New Mexico, which appears more or less intermediate between the more highly colored (*lingualis*) *albipennis* and *lacteipennis*. The *lingualis* form ("clypeus yellow with two black blotches above, sufficient to mark out the yellow T"), described from Fort Collins, Colorado, stands as a race¹; but it is very variable, and its limits have not been defined. The character of its tongue mentioned in my description is probably of no value, depending on the condition of the organ; but the palpal character may be more significant. The differences in the form of the clypeus of these bees, to which Crawford calls attention, seem to be variable and of uncertain value.

I can only conclude that this group of *Perdita* is undergoing modification through the mutation of determiners, after the manner of *Drosophila*. These changes are not adaptive and are at least largely independent, so that after defining a species or race as possessing a particular series of characters one is confused by finding that in other localities these characters are not associated. So far as the *albipennis-lacteipennis-heliophila-helianthi-lingualis* series goes, there has been no change in feeding habits, all being visitors of *Helianthus*. Whether the local distribution indicates any special adaptations to climate, we do not know. It appeared natural to find the more melanic form (*canadensis*) northward, but dark-faced insects in western Colorado and Utah were not to be expected. In New Mexico, evident offshoots from this group have become adapted to different flowers; such as *P. verbesinæ* Cockerell and *P. lepachidis* Cockerell. In Lower California there is a species (*P. sparsa* Fox) which flies in March instead of middle and late summer.

The processes leading to the formation of new species among these bees may probably be as follows.

- (1). Factorial mutations, usually independent of one another and having no adaptive significance.
- (2). Crossing between mutants and the formation of new heterozygous and homozygous genotypes.
- (3). The sorting out, in different localities, of certain characters or combinations of characters as dominant (in the sense of prevalent), possibly but not necessarily aided by natural selection or sexual selection (the latter implying preference only in the sense of recognition).

¹Cresson's *P. hyalina*, based on Colorado males, may be applicable to (and the prior name for) *lingualis*, but this is at present uncertain.

(4). The occasional coincidence of adaptive features (often physiological, or such morphological ones as size, length of tongue, etc.) which favor a change of habits or environment and permit the insects to escape from their former routine and, e.g., become attached to a different genus of plants. Observation shows that *P. albipennis*, a sunflower bee, strays to *Verbesina*. *P. verbesinæ*, a *Verbesina* (*Ximenesia*) bee, strays to *Helianthus*. When the normal flower is over, species of *Perdita* will visit other flowers. Thus there is a continual process of experimentation going on, and, if any group of bees has varied in such a manner as to make the new plant acceptable, it will readily become addicted to it and spread into those localities in which it grows. The color characters, or slight morphological differences, observed in the cabinet need not be adaptive but may only mark a race which has more subtle adaptive features. In some cases, the adaptation may be negative, the loss of some hindrance to the new mode of life.

(5). The new type having become isolated on a new plant, or geographically or seasonally, will eventually settle down to a new position of stability (aided by natural selection, which can just as well be a conservative force) which will be sufficiently remote from that of the parent species to maintain it as a distinct entity in nature, and usually prevent crossing. The complexity of the genitalia will cause comparatively slight modifications to result in physiological isolation.

Those who find it difficult to visualize these processes, should remember that, whereas variation is common and there is a continual pressure on the periphery of the environment, the development of a new species is a rare event like the winning of a prize in a lottery. The *albipennis* group of *Perdita* (Ashmead's genus *Cockerellia*) must have taken many thousands (probably hundreds of thousands) of years to produce the quite moderate series of known segregates.¹ This fact, so far from being contrary to the Darwinian hypothesis, shows the inadequacy of mutation ALONE to produce new species UNDER ORDINARY CONDITIONS OF LIFE. It is of course true that a mutating species may under experimental conditions give rise to a long series of materially different stable (homozygous) types, which when isolated will have the aspect of species. In nature, however, such isolation does not ordinarily occur unless aided by functional efficiency. This is no doubt peculiarly true of insects, the lives of which are relatively complex and full of special adaptations. In the case of some other organisms the functional side of specific char-

¹Allowance must be made for forms not yet described and for others which may have become extinct, but, even so, the number is probably not large. For a further discussion of this group, see Proc. Acad. Nat. Sci., Philadelphia, 1896, pp. 42-45.

acters is harder to explain. Thus, the island of Porto Santo, six miles long, has a marvellous series of diverse helicoid snails living under essentially the same environment. It is impossible to perceive any special adaptive significance in all this diversity, unless it lies in the attraction of like to like and consequent physiological isolation of divergent strains. Everything indicates that the snail fauna of Porto Santo is much older than the insects or plants (with rare exceptions) of the same island; the snails have survived because lacking in minute and complicated adaptive features. But, having thus survived, they have had longer to become diversified within the area.

If the above picture of bee-evolution is correct, it appears to follow that the actual segregation of a new species may occur in a relatively short time, so that the whole process might conceivably fall under human observation. It would only be noticed, however, in a region where the bees were very well known and where observations were minute and continuous. Even then, the chances of witnessing such an event would of course be remote. Much light may be thrown on the matter by careful and persistent experimental work, following such methods as those of Mr. F. C. Craighead, lately published in *Journal of Agricultural Research*, XXII, No. 4, pp. 189-220.

***Perdita snowii* Cockerell**

COLORADO: 1 ♀, Meadows, Estes Park, August 17, 1919, collected by Mr. Herbert F. Schwarz.

Originally described from Estes Park.

***Perdita sexmaculata* Cockerell**

COLORADO: 1 ♀, Regnier, at *Sphæralcea coccinea* in Gallinas Canyon, about 4400 ft. alt., June 6, 1919.

Originally described from Santa Fe, New Mexico. The specimen on *Sphæralcea* must have been a stray, as the species normally visits *Chamæsaracha*.

***Perdita ignota* Cockerell**

COLORADO: 1 ♀, Aspen, July 24-27, 1919, collected by Pearce Bailey, Jr.; 2 ♀, Tennessee Pass, about 10,300 ft. alt., August 1, 1919; 3 ♀, Boulder, two in town at *Grindelia*, one along canyon bottom toward Orodell, about 5600 ft. alt., August 7-12, 1919; 7 ♀, 31 ♂, Glenwood Springs, at edge of town, July 22-29, 1919, all except one male collected by Herbert E. Schwarz; 2 ♂, La Junta, August 12, 1920; 1 ♂, 1 ♀, Golden on top of Castle Rock, about 6200 ft. alt., August 6, 1919.

The Golden female is peculiar for having a transverse semilunar supraclypeal mark. A similar supraclypeal mark occurs in specimens of *P. xanthismæ sideranthi* Cockerell.

Perdita ignota was described from Mesilla, New Mexico, and appears to have a most unusual range in altitude and latitude for a species of this genus. There are three related forms, having no supraclypeal mark, the females of which differ thus:

Margin of stigma and adjacent nervures fuscous; abdomen without markings.

bishoppi Cockerell.

Margin of stigma and adjacent nervures wholly pale; abdomen nearly always with transverse white bands or marks.

Flagellum orange beneath..... *ignota* Cockerell.

Flagellum dull ferruginous beneath..... *crawfordi* Cockerell.

P. bishoppi, from Texas, is a good species but, after reviewing the available materials of *ignota* and *crawfordi*, I find that the described difference in the lateral face-marks is not constant and the antennal character is unimportant. On the antennal character, the specimen originally recorded from Lincoln, Nebraska, and those from Boulder, Colorado, and Texas, are *ignota*. It appears that *crawfordi* must fall as a slight variation of *ignota*, unless new characters for the separation of the northern and southern specimens can be found.

Another closely related species is *P. heterotheca* Cockerell, from Arizona.

***Perdita melanochlora*, new species**

♀.—Length about 4.5 mm. Belongs to the *ignota* group. Wings clear, but margin of stigma and of marginal cell dusky; clypeus white with two short broad black bars; no supraclypeal mark; lateral face-marks broader than high (higher than broad in *P. heterotheca*); face and front very hairy (much more so than in *heterotheca*); flagellum dull brown beneath (orange in *ignota* and *heterotheca*); mesothorax shining black, anteriorly and narrowly posteriorly green; metathorax blue; legs sepia brown; tarsi dilute sepia (not light as in *ignota*); segments 2 to 4 of abdomen with transverse cream-colored bands, the first two narrowly interrupted, the third deeply notched medially in front and behind; the bands are preceded by more or less evident pale brown bands.

ARIZONA: 1 ♀, about 3425 ft. alt. in the Santa Rosa Valley near the Comobabi Mountains, among mesquite and acacia with some pale verde and a few *Carnegia gigantea*, August 10, 1916.

Closely allied to *P. ignota* and *P. heterotheca*, but distinct.

***Perdita lutzi*, new species**

♀.—Length about 5 mm. Head and thorax green, the metathorax steel blue, mesothorax rather bluish green in front and yellower green in middle; head broad, not enlarged, cheeks unarmed; front and vertex dullish, but mesothorax highly polished; mandibles straight; face-marks, labrum and mandibles (except reddened tips) dull yellowish white; clypeus light except two faint short bars; a small transverse supra-

clypeal mark; no dog-ear marks; lateral marks very broad below, narrowing (the inner margin beyond clypeus practically straight) to a very sharp point on orbit well above level of antennæ; malar space light, but cheeks dark; tubercles and two transverse marks on upper border of prothorax light; there is also a small light mark on each side of prothorax anteriorly; mesothorax with thin white hair; tegulæ hyaline; wings milky white, with colorless stigma and nervures; legs dark basally, but tibiae and apices of femora pale yellow, tarsi white; abdomen apricot-color above and below the first two dorsal segments with straight very pale brownish bands, not reaching lateral margins.

ARIZONA: 1 ♀, southeast and of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 5, 1916.

A distinct species closely resembling *P. mellina* Cockerell, but the latter is easily distinguished by the steel-blue, highly polished front. It is singular that this species is quite different from those which visit *Baileya* in Southern New Mexico, but one of the New Mexico *Baileya* species (*P. callicerata*) was taken with it.

***Perdita nebrascensis* Swenk and Cockerell**

COLORADO: 3 ♂, Wray, August 17-19; one collected by Pearce Bailey, Jr.

***Perdita affinis* Cresson**

COLORADO. 14 ♀, 9 ♂, Meeker, at *Grindeha serrulata*, July 20-21, 1919; 9 ♀, Estes Park, July 18, 1916, and August 18-19, 1919, collected by Mr. Albert E. Butler and Mr. Herbert F. Schwarz; 1 ♂ (on top of Castle Rock), 1 ♀, Golden, August 8, 1919; 1 ♂, Walsenburg, sabina and pinyon country, June 14, 1919.

Compared with the Meeker *affinis*, the Golden form is larger in the female and with longer white marks on abdomen, while the male has conspicuous yellow marks on the fourth abdominal segment, these in the Meeker males being small or absent.

***Perdita octomaculata terminata*, new subspecies**

I find that the supposed *P. affinis* recorded from West Point, Nebraska, at *Solidago rigida*, collected by J. C. Crawford, is without dog-ear marks in the male and represents a western race of *P. octomaculata* Say. It differs from true *octomaculata* in the cream-colored (colored as in *affinis* but shaped as in *octomaculata*) marks on abdomen of female, and in the large quadrate (notched above) supraclypeal mark of male. It may be known as *Perdita octomaculata terminata*. The male is the type.

***Perdita zebrata* Cresson**

COLORADO: 1 ♂, White Rocks, near Boulder, at *Cleome serrulata*, August 13, 1919; 5 ♂, Wray, August 17-19, 1919; 11 ♀, 6 ♂, La Junta, August 12, 1920, three ♀ collected by Mrs. F. E. Lutz; 3 ♀, 3 ♂, Pueblo, vacant lots in town, August 9, 1920; 7 ♂, 22 ♀, Rifle, some from edge of swamp along railroad and the rest from an

almost bare sandy place used as a playground,¹ July 19–21, 1919; 4 ♀, 3 ♂, Grand Junction, two near town, one male remarkably small and slender, little more than 3 mm. long, August 3, 1920, the other along irrigated land, July 17, 1919; 1 ♂, Meeker, July 21, 1919; 2 ♂, 1 ♀ (with pale abdominal bands), Glenwood Springs, at edge of town, July 22–29, 1919 and August 5, 1920; 1 ♀, Ridgway, July 10, 1919. UTAH: 1 ♂ with white face-markings and more black on abdomen than usual, Huntsville near Ogden, July 26, 1920. WYOMING: 3 ♂, 2 ♀ (1 ♂ along the river, the rest on dry slopes near the river) Green River, July 2, 1920; 8 ♂ (one at *Cleome lutea*, which was practically the only bee-flower in the locality), 5 ♀, Rock Springs, June 29, 1920.

The Wyoming females have the bands on the abdomen lemon-yellow; those in New Mexico and many parts of Colorado (e.g., at Rifle) have the bands white or yellowish white. Cresson's type had yellow bands; the more southern form, which is sexually dichroic, could be called *P. zebrata canina* (*P. canina* Cockerell). However, of four females from Grand Junction, one has lemon-yellow bands, one has them yellowish white, and two have them pale yellow.

Perdita bruneri Cockerell

WYOMING: 1 ♂, Sheridan. C. W. Metz collection.

This exactly agrees with a male of *P. cockerelli* Crawford, received from Crawford. Crawford later decided that this was the true male of *P. bruneri* and described what had been called male *bruneri* as *P. svenki*.

Perdita fallax fontis, new subspecies

♀.—Clypeus with a very large cream-colored or yellowish-white triangular area, the apex directed upwards, the sides considerably longer than the base; rest of clypeus black, except a small oblique (parallel with sides of triangle) stripe on each side; mesothorax yellowish green; wings not quite so clear; pale marks on first three abdominal segments smaller.

COLORADO: 1 ♀, Glenwood Springs, at edge of town, August 5, 1920.

P. fallax Cockerell was described from New Mexico and is known to extend north to Nebraska. *P. fallax fontis* is a submelanic form, probably racial, but possibly an individual variation.

Perdita miricornis, new species

♂ (Type).—Length a little over 4 mm. Head and thorax green, the front dull and bluish green, the mesothorax and scutellum brassy green, highly polished; face, cheeks, mesothorax, pleura and anterior femora with long white hair; mandibles (except red ends), labrum and face-marks cream-color, the face nearly all pale below level of antennæ; clypeus light with two dots; supraclypeal mark large, notched above; dog-ear marks present; lateral marks large, cuneiform, ending acutely on

¹Three of the females (two from the damper and one from the drier spot) have the supraclypeal mark divided into two spots and the clypeus black with light markings.

orbits at about level of antennæ; cheeks wholly dark; antenna: pale yellow below (in front) and black behind, but last two joints of flagellum entirely black, giving the antennæ a very unusual appearance; tubercles cream-color, upper border of prothorax with indistinct pale lines; metathorax green; knees, anterior tibiæ except a large dark patch behind, middle tibiæ in front, and hind tibiæ at base, pale yellow; tarsi white, the hind ones dark apically; tegulæ pale; wings perfectly clear, stigma yellowish white, nervures colorless, poststigmatal part of marginal cell shorter than substigmatal; abdomen shining black, with bright lemon-yellow markings, consisting of two spots on first segment, and broad entire bands on 2 to 6, on 2 failing laterally, on 4 and 5 sometimes interrupted sublaterally.

♀.—Similar to the ♂, but clypeus black with a median creamy-white stripe, narrowing to a point above; no dog-ear or supraclypeal marks; lateral face-marks broad-triangular, the lower and outer sides much shorter than the inner; apical part of mandibles with a black stripe; antennæ narrowly pale beneath to apex; anterior and middle tibiæ clear pale yellow, the middle ones sometimes with a dusky mark behind; spots on first abdominal segment large and transverse; bands pale yellow, very broad, the hind margins of those on third and fourth segments irregular or undulate.

WYOMING: 20 ♀, 11 ♂, Green River, on dry slopes near the river, about 6100 ft. alt. (type locality), July 2, 1920. COLORADO: 1 ♀, Grand Junction, near town, about 4500 ft. alt., August 3, 1920.

The male runs near *P. zebrata* in the tables but is easily distinguished by the antennæ and other characters. The female runs to the vicinity of *obscurata*, *bigeloviæ*, or *nitidella*, but is very distinct from these. The variety *leucorhina* (see below) runs in the tables near *nitidella*, *albovittata*, *callicerata*, and *mentzeliarum*, but is quite different from all these.

***Perdita miricornis leucorhina*, new variety**

♀.—Clypeus yellowish white except the usual dots and two black spots on upper part.

WYOMING: 1 ♀, Green River with typical form.

***Perdita wunderi*, new species**

♀.—Length about 7 mm. Head oblong, facial quadrangle much longer than wide; front, vertex, mesothorax and scutellum dull olive-green; prothorax, mesopleura and metathorax bluish green, but the region just below and behind the wings is yellowish, almost brassy; clypeus very pale yellow, with a very large thick black horseshoe-shaped mark, the middle part on the lower margin; no supraclypeal mark; lateral marks L-shaped, with the lower part very thick; face not hairy; cheeks entirely yellowish green, distinctly shining; labrum piceous, depressed in middle; mandibles slender, gently curved, pale yellowish, broadly ferruginous apically; flagellum dull pale ferruginous beneath except at base; mesothorax with short hair; no light color on thorax; wings milky hyaline, nervures rather dilute fuscous, stigma hyaline with a fuscous margin; first recurrent nervure meeting first transversocubital; legs piceous, with anterior knees and tibiæ in front light yellow; abdomen piceous, first

three segments each with a pair of obscure slender transverse yellowish lines, representing rudimentary bands. Maxillary palpi 6-jointed. Claws cleft.

COLORADO: 1 ♀, Wray, August 1, 1919.

Differs from *P. nebrascensis* Swenk and Cockerell by the green metathorax, marking of clypeus, absence of supraclypeal mark, shape of lateral marks, scape black with obscure reddish ends, color of flagellum, dark tubercles, etc. In the tables it runs near *P. verbesinæ*, but is easily separated by the dull thorax.

It is dedicated to Mr. Chas. Wunder, who with extraordinary skill and patience mounted the whole collection, making it available for study.

***Perdita bisignata*, new species**

♀.—Length about 4.5 mm. Head and thorax dark bluish green, the mesothorax posteriorly black, the metathorax (dull above) dark blue; labrum, base of the slender gently curved mandibles, and face-marks lemon-yellow; clypeus yellow with the usual dots, and two black cuneate marks above, their base on the upper margin, supraclypeal area with a pair of elongated spots or bars; lateral marks shaped like a shoe with very slender toe and flat sole, based on orbit, the very acute upper end at level of antennæ; cheeks entirely dark; flagellum pale ochreous beneath; front dull, vertex shining; mesothorax dullish; wings dusky, stigma and nervures dark brown, the outer recurrent pallid; legs black with pale knees, anterior tibiæ broadly and middle ones more narrowly pale yellowish in front, anterior and middle tarsi pale reddish; abdomen shining black, with a small yellow spot at each side of third segment.

INDIANA: 2 ♀, Lafayette, about 550 ft. alt., August 16, 1920.

Runs near *P. asteris* in the tables, but very distinct.

***Perdita nolinæ*, new species**

♀.—Length about 5 mm. Head and thorax (including front) shining green; face blue-green; mesothorax olive-green, the posterior disc black; metathorax bluish green, very shining; the following parts yellow, labrum, mandibles (except tips), clypeus (except the usual dots and two spots above, varying to distinct bars), minute transverse lateral face-marks (just above lateral extensions of clypeus), anterior border of prothorax above and a pair of minute spots on posterior border, and tubercles broadly; head broad; face not hairy; scape reddish at ends and dark in middle; flagellum dusky yellowish (or reddened by cyanide) beneath; mesothorax with very thin short hair; wings clear hyaline, nervures colorless, substigmatal portion of marginal cell much longer than poststigmatal; legs yellow, with the hind tibiæ and tarsi dark brown, and the anterior femora black on basal half in front, and more than half behind; abdomen black with broad entire yellow bands at bases of segments 2 to 4 not continued to lateral margins and an apical band on fifth segment; venter yellow.

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mountains, about 3800 ft. alt. Type, among river-bottom vegetation, July 8-20, 1916; cotype, at flowers of *Nolina microcarpa*, July 8-12, 1916. The cotype has pale lateral dots on sides of face.

The nearest relative seems to be the Californian *P. rhois* Cockerell. In my table in Proc. Acad. Nat. Sci., Philadelphia, 1896, *P. nolinæ* runs out at 69.

***Perdita calloleuca*, new species**

♂.—Length about 3 mm. Dark parts of head and thorax shining dark bluish green; the following parts white, tinged with yellowish dorsad, as on front and upper part of prothorax, face up to level of facial foveæ (with a further short broad extension in middle), labrum, mandibles (except tips), large quadrate or triangular area on lower part of cheeks, prothorax including tubercles, and large patch (emarginate posteriorly) on anterior part of mesopleura; head large, quadrate, facial quadrangle broader than long; cheeks simple; mandibles long, slender and curved; mesothorax small, highly polished, not conspicuously hairy; scape very pale yellow; flagellum light yellow beneath, above reddish, more dusky at base; wings clear hyaline, nervures colorless, except margins of stigma and marginal cell, which are fuscous; legs pale lemon-yellow, hind tibiæ and tarsi brown behind; abdomen with broad entire lemon-yellow bands on all the segments, broader than the black intervals between them; venter yellow.

COLORADO: 2 ♂, Grand Junction, along irrigated land near town, about 4600 ft. alt., July 17, 1919.

Allied to *P. pellucida* Cockerell, but differs by shining vertex, and ornamentation of cheeks and abdomen.

***Perdita solidaginis*, new species**

♂.—Length, 5 mm. or a little over. Head and thorax bluish green, the mesothorax a yellow-green, shining but not polished; mandibles (except tips), labrum, face below level of antennæ, and lateral marks forming acute angles on orbits about half-way up front, all pale yellow; posterior orbits with a very narrow yellow line more than half-way up cheeks; cheeks, vertex and pleura with long white hair, but face not hairy; scape pale lemon-yellow, with only a small dark spot behind; flagellum dark brown above with the suture darker, pale yellow below, the last joint brown; narrow anterior border and two large cuneiform marks on hind border of prothorax above, tubercles and a zigzag line below, yellow; tegulæ hyaline with a pale yellow spot; wings clear hyaline, nervures and stigma very pale brown; substigmatal part of marginal cell about as long as poststigmatal; legs yellow, all the femora mainly black behind, the hind ones yellow only above and at ends; anterior and middle tibiæ with a large black mark behind, hind tibiæ black with a yellow stripe in front; anterior and middle tarsi whitish, hind tarsi dark; abdomen black with narrowly interrupted transverse lemon-yellow bands on first five segments; venter yellow, brownish subapically, and with four round brown spots subbasally.

COLORADO: 1 ♂, White Rocks near Boulder, at flowers of *Solidago*, August 13, 1919. Collected by Mrs. W. P. Cockerell.

Allied to *P. sphæralceæ*, but face considerably longer, etc. Very close to *P. erigeronis* Cockerell, but larger, face-marks much more narrowly cuneate, and legs differently colored. *P. rectangularata* Cockerell was described from the male and female taken at *Solidago* at Fort Collins, Colorado. The female is the type, and it is now known that the male supposed to belong with it is *P. affinis*. It may be that *P. solidaginis* is the real male of *P. rectangularata*, but, as the probabilities seem to be against it, I describe it as distinct.

***Perdita wyomingensis*, new species**

♀.—Length 5 mm. or rather more. Robust, with wide abdomen; head and thorax dark bluish green, front and vertex dull, mesothorax and scutellum highly polished, with very little hair; head broad; labrum pallid, with a deep dark pit; mandibles pallid, black at apex and red subapically; cheeks hairy, entirely dark; clypeus and triangular lateral face-marks very pale yellowish, the clypeus with two broad black bars, straight on inner side and convex on outer, not reaching upper or lower margin; no supraclypeal mark; upper border of prothorax entirely dark, but tubercles pale yellow; metathorax bluish, the upper surface shining but not polished; tegulae pale brown; wings clear hyaline, nervures almost colorless, stigma very pale yellowish; marginal cell unusually long; legs black, the anterior and middle tibiae in front, and knees, yellow; abdomen with yellow markings, consisting of a spot at each side of first segment, and interrupted bands on segments 2 to 5, these bent downward at the thick outer ends, that on second segment very widely interrupted, on fifth slightly; apex of fifth segment pale reddish; apical plate pale reddish basally, apically prolonged into a narrow picaceous almost spine-like process; venter picaceous, with a yellow spot in middle of third segment, fourth narrowly edged with yellow, and subemarginate in middle, margin of fifth segment and all of sixth pale ferruginous.

WYOMING: 1 ♀, Jackson, moderately moist pasture land, about 6300 ft. alt., July 1, 1920.

Differs from *P. affinis* Cresson by the polished mesothorax, and from *P. obscurata* Cresson by the clypeus, etc. The abdominal characters are very distinctive.

***Perdita (Cockerellia) wickhami*, new species**

♀.—Very close to *P. albipennis* Cresson, and at first sight appearing identical, but readily distinguished by the following characters. Mandibles dark red, blackened at base; clypeus with large yellow spots at lower corners, a square yellow mark in middle apically, and above and barely separated from the last a vertical yellow stripe, bulbous at base, then linear, and ending above like the head of a nail viewed laterally; scape yellow in front; flagellum bright deep ferruginous beneath, except basally; front entirely dull, without evident punctures, only the narrow orbital margins shining; tegulae blackened anteriorly, pale red posteriorly; wings clear, but not strongly milky as in *albipennis*, stigma and nervures pale ferruginous, outer recurrent and transversocubital weak; disc of mesothorax more distinctly punctured; apical plate

of abdomen broad, piceous with a broad ferruginous apical margin, strongly emarginate. The abdomen has four broad chrome-yellow bands, and yellow spots at sides of first segment. The last two joints of the maxillary palpi are of equal length.

OKLAHOMA: 1 ♀, South McAlester, June 11. (H. F. Wickham). From Zabriskie collection.

In *P. albipennis helianthi* Cockerell, ♀, the apical plate is entirely pale ferruginous and is not emarginate.

The following key separates the new species of *Perdita*, and compares them with several others.

1. Abdomen orange, without distinct bands or markings. *lutzi* Cockerell.
Abdomen dark, or distinctly banded. 2.
2. Face without light markings, but labrum light, and mandibles largely lemon-yellow. *pallidipennis indianensis* Cockerell, ♂.
Face with light markings, or all light. 3.
3. Face below antennæ wholly or mainly pale, the dog-ear marks present; males. 4.
Face below antennæ mainly or partly dark, the dog-ear marks absent. 10.
4. Mesothorax highly polished. 5.
Mesothorax dullish. 7.
5. Larger; flagellum beneath pale yellow, with the last two joints black.
miricornis Cockerell.
Smaller; antennæ not so colored. 6.
6. Head large, quadrate; face white. *calloleuca* Cockerell.
Head small; face yellow. *zebrata* Cresson, small male (Grand Junction).
7. Lateral face-marks cuneate above, the inner margin above antennæ straight. 8.
Lateral face-marks with inner margin above antennæ angulate or not straight. 9.
8. Middle femora thickened; mesothorax dull.
bruneri Cockerell (*cockerelli* Crawford).
Middle femora ordinary; mesothorax more shiny. *solidaginis* Cockerell.
9. Larger; four interrupted yellow bands on abdomen.
affinis Cresson, male (Golden).
Smaller; three interrupted yellow bands on abdomen.
affinis Cresson, male (Walsenburg).
10. Abdomen with at least three broad entire light bands. 11.
Abdomen without such bands. 14.
11. Clypeus nearly all light. 12.
Clypeus dark with a light band, and sometimes spots. 13.
12. Lateral face-marks larger, pyriform, *miricornis* var. *leucorhina* Cockerell.
Lateral face-marks rudimentary. *nolinæ* Cockerell.
13. Larger species; clypeus with large lateral spots. *wickhami* Cockerell.
Small species; clypeus without such spots; mesothorax polished.
miricornis Cockerell.
14. Supraclypeal mark or marks present. 15.
Supraclypeal mark absent. 16.
15. Wings milky white; face-marks white. *ignota* Cockerell, variety, ♀.
Wings dusky; face-marks yellow; abdomen black with two small yellow spots on third segment. *bisignata* Cockerell.

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A FOSSIL MOTH FROM FLORISSANT, COLORADO

By T. D. A. COCKERELL

In 1909 a collection of fossils from the Miocene shales of Florissant, Colorado, was obtained by Messrs. Sternberg, Duce, and Rusk, and transmitted to The American Museum of Natural History. The new species were described by the present writer in the Bulletin of the American Museum, XXV (1910), with the exception of a moth, which was retained with the expectation that it would be described by another. More than ten years have passed and, as the moth has never been recorded, it seems desirable to offer a description. It is represented by a single anterior wing, but this is unusually well preserved. It is a member of the Geometridæ and, although its generic position, in the absence of antennæ, palpi, etc., must remain somewhat uncertain, it appears to fall in the large modern genus *Hydriomena* of Hübner.

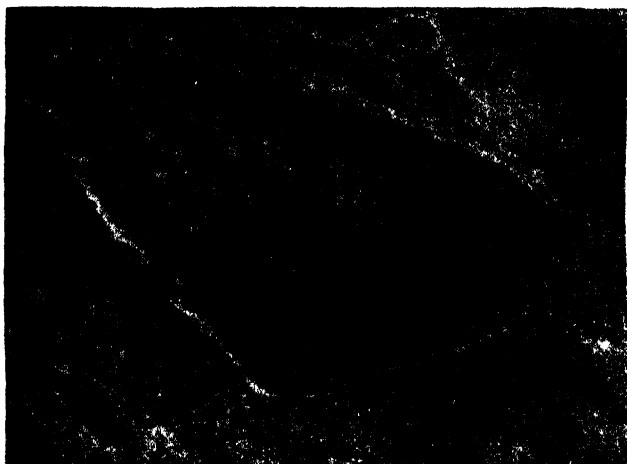


Fig 1 Fossil Moth, *Hydriomena* (?) *protrita* Enlarged

***Hydriomena* (?) *protrita*, new species**

Anterior wing, length 23 mm ; costa distinctly arched before apex, outer margin 14.5 mm., gently convex; hind margin 17 mm., basal space somewhat pallid, subbasal line very faint, but apparently arched outward, its lower part directed basad, and sharply angled a short distance above hind margin, in the manner of *H. manzanita*

Taylor, except that the curve is less abrupt and the angle is more pronounced; antemedian band also formed after the manner of *H. manzanita*, but more distant from base of wing, with the outward curve broader and less abrupt, though the posterior curve or loop and the angle between the two are nearly the same in the two species; the costal region is strongly infuscated, the dark color being broken by the antemedian band, which appears as a pale subvertical line; near the end of the cell is a distinct discal spot or pair of short transverse bars, apparently representing the dark antemedian mark of *H. manzanita*; the postmedian line is not so far from the antemedian as usual and appears to be formed much as in *H. albifasciata* Packard, inwardly bounding the dark apical and outer marginal areas; the fringe on the outer margin is chequered, as in many species.

The specimen bears the number 14.

So far as it is possible to see, this insect is of an entirely modern type. It is the first American fossil geometrid. The fossil Lepidoptera of Florissant, so far as known at present, are as follows, extinct genera being marked with an asterisk.

BUTTERFLIES

PIERIDÆ

Stolopsyche Scudder*
libytheoides Scudder

LIBYTHEIDÆ

Barbarothea Scudder*
florissanti Scudder
Prolibythea Scudder*
vagabunda Scudder

NYMPHALIDÆ

Prodryas Scudder*
persephone Scudder

Jupitertia Scudder*

charon Scudder

Lithodryas Cockerell*

styx (Scudder)

Apanthesis Scudder*

leuce Scudder

Chlorippe Boisduval

wilmattæ Cockerell

Nymphalites Scudder*

obscurum Scudder

scudderi Beutenmüller
and Cockerell

MOTHS

SATURNIIDÆ

Attacus (?)
fossilis Cockerell

GEOMETRIDÆ

Hydriomena (?)
protrita Cockerell

TORTRICIDÆ

Tortrix (?)
florissantana Cockerell
destructus Cockerell

ETHMIDÆ

Ethmia (?)
mortuella Scudder

FAMILY UNKNOWN (larva)

Phylledestes Cockerell*
vorax Cockerell

It will be noticed that the butterflies with one exception are assigned to extinct genera. The moths, on the other hand, are doubtfully referred to living genera. It is possible that if we knew the moths better, we could distinguish them from living genera; but it must be confessed that there is nothing in their appearance to suggest this.

169 32 D (86 6)

A NEW FOSSIL RODENT FROM ECUADOR

BY H E ANTHONY

Mr A M Tweedy, Resident Manager of the mines of the South American Development Company at Portovelo, Ecuador, who has given such great assistance to the expeditions of the American Museum in Ecuador, has added to the collections a most interesting genus of fossil rodents. He gave to Mr George K Cherie, who was in charge of the Museum's late expedition to Ecuador, July 1921 to January 1922, parts of a skull and skeleton of a large hystricomorph rodent related, among fossil genera, to *Neotomys* of the Santa Cruz beds, and among living forms to *Myocastor*. This material Mr Tweedy secured from Señor Carrasco who owns a large hacienda near Nabon, Provincia del Azuay. The accompanying diagram will show the nature of the locality where this rodent was found (Fig 1).

Nabon is in the interandean area, at an elevation of about 9000 feet. The region is open and treeless, the only forest being found in scattered clumps along the higher ridges to the east. Although this section has a

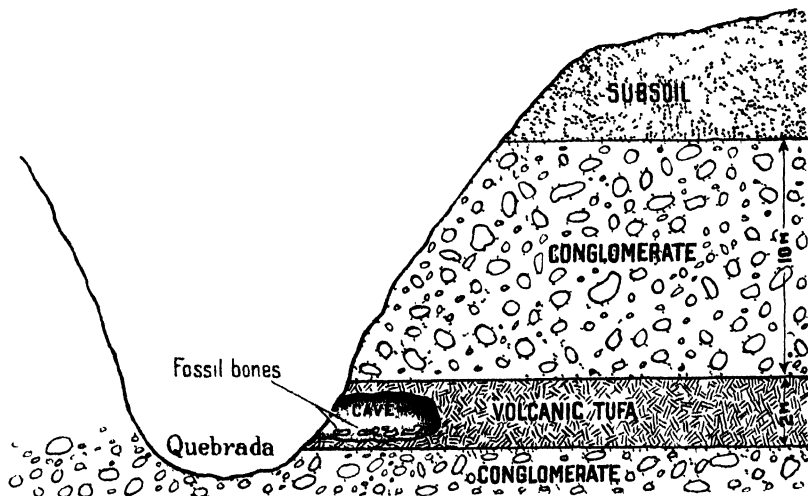


Fig 1 Diagram based upon a sketch made by Mr A M Tweedy who was given the data by Señor Carrasco, the original collector of the fossil bones. The entrance to the cave was unearthed by a landslide.

comparatively long dry season and for most of the year is a region of extreme aridity, it is visited by torrential rains which erode the topography and scour out the ravines.

There is little doubt that this hystricomorph lived in the Pleistocene and such an interesting find leads one to hope that additional researches in Ecuador will bring to light more of the members of the preceding epochs.

I am indebted to Dr. W. D. Matthew, Curator of the Department of Palæontology of the American Museum, both for permission to describe this material which belongs in his department and for helpful discussions upon the material itself.

Drytomomys, new genus

A large hystricomorph rodent with very heavy incisors which have a thick cutting edge of enamel; molars rooted but fairly hypsodont, crown pattern made up of a series of deep reëntrant loops which become isolated by wear to form enclosed lakes, the normal number of which is three. There is a very deep fossa in the lateral face of the premaxillary.

Genotype: *Drytomomys æquatorialis*.

Drytomomys æquatorialis, new species

TYPE: No. 13219, Department of Vertebrate Palæontology, from Nabon, Prov. del Azuay, Ecuador, near the hacienda of Señor Carrasco, who took the bones from the cave. The type is a fragmentary skull, only the anterior portion of the cranium, carrying four molar teeth, and the anterior portion of the mandible, all of the teeth present. Accompanying these parts of the skull are a few fragments of limb bones, etc.

DESCRIPTION.—General proportions of cranium unknown; a very deep and apparently extensive fossa is indicated as lying in the lateral face of the rostrum, partly in the premaxillary, partly in the maxillary; incisive foramina probably of fair size; mandible robust and heavy, typically hystricomorph; incisors, upper and lower, very large and strong, proportionally enormous, rather deeper than broad and with well-developed cutting edge of heavy enamel; molar teeth rooted but with high crowns, four in each jaw; molar pattern simple, formed by a series of reëntrant loops of enamel which enter from the inside in the case of the upper molars, externally in the lower series; in the state of wear shown by the type most of these loops have been cut off to become completely detached lakes, elliptical in outline, while the tooth is sub-columnar in shape, completely encircled by enamel with scarcely any trace of the entering loop which was ancestral to the lake; true molars with typical pattern of three loops or lakes, lower premolars with two main lakes and three (left) or four (right) additional small lakes.

MEASUREMENTS.—Length of upper diastema, approximate, 32 mm.; dimensions of upper premolar, 7.8×8.7; dimensions of m¹, 6.3×6.8; dimensions of m², 7.2×7.5; length of mandibular toothrow, I-M₃, 60; crown length of mandibular molar series, 31.5; dimensions of lower premolar, 9.5×6.7; dimensions of m₁, 6.2×7; dimensions

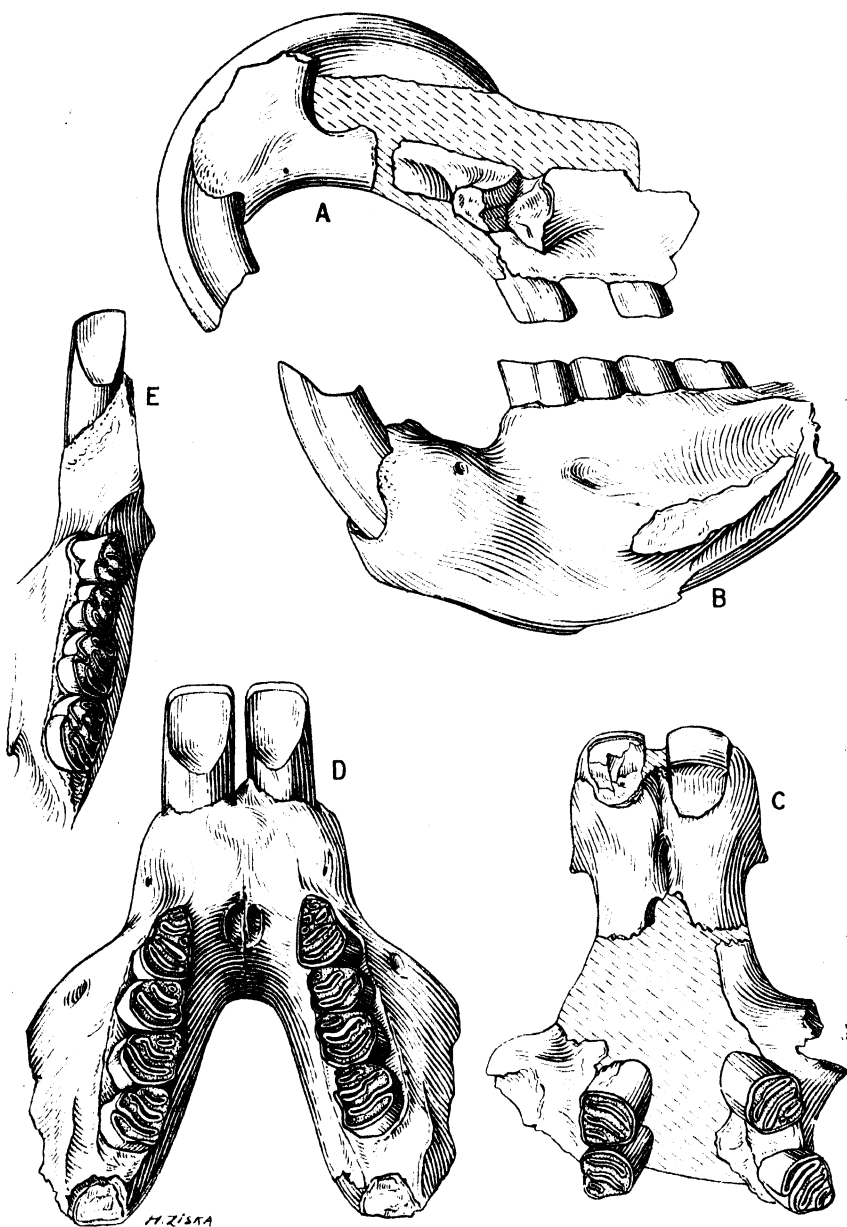


Fig. 2. A, B, C, D, *Drytomomys equatorialis*, type specimen (A. M. Dept. Vert. Pal. 13219, Nat. Size). E. *Myocastor coypus* (A. M. Dept. Mam. 42751, Nat. Size).

of m_2 , 7.5×7.4 ; dimensions of m_3 , 8.8×7.5 ; breadth of upper incisor, 8.4; depth of upper incisor, 10.7; breadth of lower incisor, 8.4; depth of lower incisor, 10.2.

Drytomomys may be readily distinguished from all living rodents by its excessively developed incisors and by the molar pattern of completely isolated enamel lakes. While the skull is of about the same size as in the genus *Castor*, the incisors are actually twice as heavy and the enamel cutting edge is conspicuously heavier. It was because of this highly developed chisel-like incisor that the new genus was named *Drytomomys*, from the Greek *δρυτόμος*, a wood cutter and *μυς*, a mouse. If I am correct and this rodent was a woodcutter, it was even better equipped than the beaver, and bearing out this assumption is the presence of the deep lateral fossa of the rostrum which undoubtedly mark the attachment area of a greatly developed masseter muscle.

Apparently its closest affiliations with living rodents are with *Myocaster*. The molars of this genus, in the worn stage, show a fairly close approximation to the condition seen in the fossil genus. However, *Myocaster* molars have an extra reentrant, internal in the upper series, external in the lower, which the *Drytomomys* tooth lacks. A specimen of *Myocaster* (No. 42751) has a molar tooththrow equal in length to that of the new genus, but the incisor teeth are about half as heavy.

Among fossil genera, *Neoreomys* is similar in many details to the Ecuador rodent but differs from it in the same characters as does *Myocaster*. In fact *Neoreomys* resembles *Myocaster* more closely than it does *Drytomomys*. No other genus of the Santa Cruz fauna bears as close a relationship to *Drytomomys* as does *Neoreomys*, but *Drytomomys* is so obviously related to this genus that it would appear perfectly at home in any collection from the Santa Cruz formation.

The fragments of limb bones present, the head of a humerus, distal end of an ulna, head of a femur and badly broken distal end of a tibia, all indicate an animal of robust and heavy build. These limb bones are very much larger than those of *Myocaster* and only a little less robust than those of *Hydrochaerus*.

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BEES OF THE GENUS *PANURGINUS* OBTAINED BY THE AMERICAN MUSEUM ROCKY MOUNTAIN EXPEDITIONS

BY T. D. A. COCKERELL

The bees recorded below were collected by Dr. Frank E. Lutz, except when the contrary is stated. I have included certain species of *Greeleyella* and *Hypomacrotera*, which are likely to be confused with *Panurginus*.

The genus *Panurginus* was first distinguished by Nylander in 1848, the type being *P. niger* Nylander, known from a female, 5 mm. long, collected by Sahlberg in Siberia. Nylander thought that the lack of copious pollen-carrying pubescence indicated a parasitic mode of life and, on this ground, separated the genus from *Panurgus*. The hair on the legs was, however, more abundant than that on the body. When Friese revised the Palæarctic *Panurginæ* in 1901, he had not seen *P. niger*, nor have any additional specimens been collected, so far as I am aware. The species is not in the British Museum, at Oxford, or in any of the American collections. The precise definition of *Panurginus*, therefore, remains somewhat uncertain, though it is probable that *P. niger* belongs to the genus as we now understand it.

F. Morawitz in 1876 founded a genus *Epimethea* on certain species differing from *Panurginus* in having yellow tegumentary markings on the abdomen and other parts of the body. *E. variegata* F. Morawitz may be taken as the type. It is recorded as occurring in the Caucasus and in Algeria. Probably *Epimethea* should be recognized as a genus but, although I have seen *E. variegata* in the British Museum, I have never made a close examination of any species of this group.

In 1894 Gribodo based his genus *Scrapteroides* on *S. difformis* Gribodo, which is now considered identical with *Panurginus albopilosus* (Lucas), a species of Spain and Algeria. I possess this species and find that it has a black face in the male and that the first recurrent nervure falls considerably basad of the first intercubitus (transversocubital). In these respects it resembles our American *P. atriceps* (Cresson), but the latter has a much longer flagellum in the male.

Panurginus is confined to the Palæarctic, Nearctic, and Neotropical Regions. If we exclude *Epimethea* (6 species), *Greeleyella*, and *Pseudo-panurgus*, we find that, as at present known (including the species de-

scribed below), *Panurginus* has 51 Nearctic, 25 Neotropical, and only 20 Palæarctic species. In the Swiss Alps and adjacent regions one may find *P. montanus* Giraud (1861) visiting flowers of *Ranunculus* and *Hieracium*. But the collector who would obtain other species has to travel far—to Spain for *P. albopilosus* Lucas and *P. hispanicus* Giraud, to northern Sweden for *P. romani* Aurivillius, to Russia for *P. lactipennis* Friese¹ and *P. sculpturatus* Morawitz. Contrast with this the abundance of species in our Rocky Mountain country, which appears to be the headquarters of the genus. In Asia, species occur in Japan (*P. crawfordi* Cockerell) and China (*P. nitidulus* Morawitz, *P. nigripes* Morawitz, *P. pictarsis* Cockerell), but we do not find them in the typical Oriental tropics. In America, on the other hand, they occur in the moist tropics, as in the "Tierra caliente" of Mexico (*P. bidentis* Cockerell) and in Brazil (*P. solani* Ducke). Nevertheless, the strictly tropical species are not very numerous.

If we are surprised that the Central European *P. montanus* has not produced any segregates, we must note that our closely analogous species, *P. cressoniellus*, is also without a series of closely related forms. These bees are indiscriminate feeders on a considerable series of flowers, and it appears to be true that oligotropic habits favor the evolution of new species. We know that species of *Greeleyella* and *Hypomacrotera* are oligotropic and there are reasons for regarding several species of *Panurginus* as such, but the subject requires much more minute study. In general sweeping, it is easy to obtain from a clump of flowers bees which were not actually feeding on the flowers cited, and even oligotropic bees wander from their proper plants at times.

The collections of Dr. Lutz greatly increase our knowledge of the species and distribution of western *Panurginus*, but it is evident that, with all that has been done, we still have but an imperfect knowledge of this rich fauna.

***Panurginus irregularis*, new species**

COLORADO: 2 ♂, Boulder, about 5300 ft. alt., on plains, August 12, 1919.

Taken with *P. piercei* Crawford and *P. nebrascensis* Crawford. Related to *P. horizontalis* Swenk and Cockerell, but easily known by the dark tubercles and other characters.

♂.—Length about 6 mm.; slender. Black; mandibles (except apex), labrum, and face up to level of antennæ bright yellow, upper level of yellow irregular, denticiform, with a slender process on each side a little way up orbits. Second joint of labial palpi much longer than third; third and fourth subequal. Process of labrum very broad, truncate. Front dull, vertex shining, with distinct punctures. Scape yellow

¹The British Museum has specimens of *P. lactipennis* from Persia.

in front; flagellum pale ferruginous beneath except base and last joint, the latter abruptly dark. Thorax above with thin dull white hair; mesothorax and scutellum polished, with sparse distinct punctures; area of metathorax with fine rugæ; tubercles black (yellow in *P. horizontalis*); tegula testaceous. Wings strongly dusky; nervures fuscous, stigma dilute reddish; second submarginal cell much shorter than first, receiving the recurrent nervures about equally distant from base and apex. Femora black, yellow at apex; tibiae yellow, the anterior ones with a black patch behind, middle and hind ones each with two black marks (tibiae thus as in *P. citripes* Ashmead, but face-marks different); tarsi yellow, reddish apically; abdomen with fine punctures. The clypeus has a fine median groove.

***Panurginus altissimus*, new species**

COLORADO: 1 ♂ (Type), 2 ♀, Ouray, about 8000 ft. alt., July 11, 1919, collected by Herbert F. Schwarz; 1 ♀, Ouray, about 8500 ft. alt., sweeping grass among Douglas fir, aspen, scrub oak, etc., July 11, 1919.

♂ (Type).—Length about 7 mm., rather slender. Black; mandibles black; labrum black, but the process pale yellow, with sloping sides, and the binodose or submarginate apical margin black; clypeus, irregularly subtriangular supraclypeal mark and large triangular lateral face-marks (almost reaching upper corners of clypeus) sulphur-yellow. Clypeus sparsely punctured, and with a faintly indicated median groove. Scape black; flagellum black, very obscurely reddish beneath. Mesothorax and scutellum polished, sparsely punctured; area of metathorax finely plicatulate; tegulae rufous, piceous in front. Wings dusky, especially the broad apical margin; stigma and nervures dark brown; first submarginal cell about as long as second on lower side; first recurrent nervure joining second submarginal cell a long way from base, fully three times as far as second from apex. Legs (including anterior tibiae) black, small joints of tarsi becoming brownish apically. Abdomen ordinary, with very fine punctures.

♀.—Length about 7 mm. Black without light markings. Mesothorax highly polished, almost impunctate.

The female is so like *P. piercei* Crawford that I should have regarded it as a mountain race with dusky wings, but the male is much more different.

***Panurginus opaculus*, new species**

ARIZONA: 1 ♀ (Type), Mud Springs, Pine Canyon, Sta. Catalina Mts., about 6800 ft. alt., among oak, pinyon, juniper, walnut, etc., July 17–20, 1916; 1 ♀, same locality, August 19, 1916.

♀.—Length about 5 mm. Black. Clypeus and supraclypeal area shining, rather closely punctured. Antennae dark, the flagellum very obscurely brownish beneath. Mesothorax dull, with a strong median groove; scutellum shining, flattened on disc, finely punctured; tegulae rufous. Wings dusky, stigma and nervures very dark brown.

Very close to *P. pauper* Cresson (specimens collected by Banks at *Ceanothus*, Falls Church, Va., compared) and at first sight appearing identical, but distinguished by the dark antennae, granular basal area of metathorax (plicatulate in *pauper*), and very broadly truncate process of

labrum (rounded in *pauper*). It is larger than *P. flavotinctus* (Cockerell) and has the process of labrum more broadly truncate (*flavotinctus* having the labrum intermediate between *pauper* and *opaculus*).

***Panurginus pernitens*, new species**

ARIZONA: 1 ♀, S. E. of Kitt's Peak, Baboquivari Mts., about 4000 ft. alt., among mesquite with considerable oak, August 1-4, 1916.

♀.—Similar to *P. opaculus*, and at first glance appearing identical, but easily distinguished by the rather oblong head, with facial quadrangle considerably longer than broad. Clypeus and supraclypeal area elevated, forming a very obtuse ridge, with a few scattered punctures on a highly polished surface. Process of labrum narrower than in *P. pauper*, rounded at end. Area of metathorax minutely, microscopically plicatulate. Stigma rather dilute reddish-sepia. Ventral abdominal segments pale reddish basally. Compared with *P. pauper*, the wings are longer, hyaline (not dusky as in *pauper*) and the stigma is smaller. The mesothorax, though excessively finely punctured, is somewhat shining, and the scutellum is similarly sculptured. The flagellum is bright ferruginous beneath except at base. The insect is much larger than *P. flavotinctus*.

The following key separates the females of the *pauper* group.

1. Flagellum entirely dark.....*opaculus* Cockerell.
Flagellum red beneath except at base.....2.
2. Facial quadrangle much longer than broad.....*pernitens* Cockerell.
Facial quadrangle about square.....3.
3. Larger; process of labrum rounded.....*pauper* (Cresson).
Smaller; process of labrum subtruncate.....*flavotinctus* (Cockerell).

***Panurginus porterae* Cockerell**

ARIZONA: 1 ♂, 1 ♀, near Soldier's Camp, Sta. Catalina Mts., about 9100 ft. alt., at flowers of *Oenothera*, July 14, 1916. COLORADO: 2 ♂, Estes Park, one, July 23, 1916, collected by A. E. Butler, the other August 18, 1919, collected by Herbert F. Schwarz.

The Arizona female cannot be distinguished from *porterae* from Beulah, New Mexico. The Arizona male is smaller, and has the eyes very dark gray instead of green. This male certainly appears to be conspecific with the form I recorded (Ann. Mag. Nat. Hist., April 1916, p. 279) from Pecos, New Mexico, as *P. picipes* Cresson. The original *picipes* was based on two males collected by Belfrage in Texas. Mr. W. J. Fox kindly sent me a drawing of the face of Cresson's type, and it shows the band-like lateral marks sharply truncate above, with the inner corner of the truncation a little higher than that on the orbit. My so-called *picipes* have the lateral marks pointed on or very close to the orbital margin and are nearer to *porterae*. It is possible that they should be separated, but at present I regard them as a form of that species. The

Arizona male has the basitarsi black; the hind ones are largely testaceous in the Pecos specimens.

***Panurginus perlævis* (Cockerell)**

COLORADO: 1 ♂, 4 ♀, Wray, about 3700 ft. alt., August 17-19, 1919. One female was collected by Pearce Bailey, Jr. A male and female were at *Helianthus*.

This is very close to *P. piercei* Crawford, but amply distinct. The females may be separated thus:

Flagellum beneath bright ferruginous in middle and dark at ends; clypeus not depressed in middle and may be faintly carinate; supraclypeal area with many punctures.....	<i>perlævis</i> .
Flagellum beneath dusky reddish from near base to apex; clypeus depressed in middle; supraclypeal area with very few punctures.....	<i>piercei</i> .

Male *perlævis* differs from *piercei* by lack of the median groove on clypeus. There is only a small yellow triangle on the supraclypeal area, and between this and the lateral marks are large black areas (the outline of the yellow forming a broad W), while the lateral marks are obliquely truncate above. The flagellum is light yellowish-ferruginous beneath, except the last two joints and extreme base. The hind tibiæ have about the basal half yellow (less in *piercei*), and the wings are not dusky. The process of labrum is yellow with a black apical margin, very broadly truncate, the truncation somewhat concave.

The type of *P. perlævis* was collected on *Helianthus* at Las Cruces, New Mexico.

***Panurginus piercei* Crawford**

COLORADO: 1 ♂, Boulder, about 5300 ft. alt., on the plains, August 7-12, 1919.

***Panurginus nebrascensis* Crawford**

COLORADO: 2 ♂, Boulder, about 5300 ft. alt., on the plains, August 7-12, 1919; 1 ♂, Denver, August 28, 1919, collected by Barbara M. and Marjorie D. Schwarz.

Crawford (1912, *Canad. Ent.*, XLIV, p. 368) states that the tibiæ are completely annulate with black. They are not so in the Boulder specimens, nor in a cotype received from Crawford.

***Panurginus atricornis* (Cresson)**

COLORADO: 2 ♂, 4 ♀, Estes Park, two females collected by Herbert F. Schwarz, August 13-14, 1919, the remainder by A. E. Butler, July 19, 1916, at about 7800 ft. alt.

The males agree with *P. atricornis* from Beulah, New Mexico, and Viereck recognized this as *atricornis* after seeing Cresson's type. Cresson's description agrees, except that he says the face-marks are white,

perhaps in consequence of using artificial light. The females differ from *P. porteræ* by having the highly polished mesothorax almost impunctate. Many years ago Mr. Fox sent me a supposed ♀ *P. ornatipes*, from Colorado, out of the Cresson series. It is not *ornatipes*, but *atricornis*.

***Panurginus renimaculatus* (Cockerell)**

WYOMING: 1 ♀, Sheridan, collected by C. W. Metz.

***Panurginus didirupa* Cockerell**

COLORADO: 1 ♂, Estes Park, August 17, 1919, collected by Herbert F. Schwarz; 2 ♂, 2 ♀, Ward, August 8-10, 1919, the females collected by Miss Sara Branham; 1 ♂, Elbert Creek, near Electric Lake, La Plata Co., about 10,000 ft. alt., June 30, 1919. IDAHO: 1 ♀, near Montpelier, about 6100 ft. alt., July 6, 1920.

The female is smaller than *P. porteræ*, with the sides of face shining and finely punctured, and the wings strongly brownish.

***Panurginus bakeri* (Cockerell)**

ARIZONA: 1 ♀, southwest end of Coyote Mts., about 3500 ft. alt., among mesquite, palo verde, etc., August 4-7, 1916; 1 ♀, Bear Wallow, Sta Catalina Mts., about 8100 ft. alt., near Soldier's Camp, among Douglass firs, etc., at (?) *Pseudocymopterus montanus*, July 13, 1916. COLORADO: 1 ♀, Ouray, about 10,000 ft. alt. on Summit Road, July 13, 1919; 1 ♀, in a meadow at Warren Lake, near Aspen, about 10,800 ft. alt., July 26, 1919; 1 ♂, Electra Lake, near Durango, about 8400 ft. alt., at *Potentilla filipes*, June 29, 1910; 3 ♀, 1 ♂, Leadville, about 10,200 ft. alt., in the town, August 4, 1919, collected by Bailey, Schwarz, and Lutz; 1 ♂, 1 ♀, Ward, August 9, 1919, collected by Sara Branham; 3 ♂, 5 ♀ (one female with two femalestylopids, *Crawfordia*), Tennessee Pass, about 10,300 ft. alt., August 1-8.

For a description of the female, see Cockerell, 1910, *Psyche*, XVII, p. 245.

***Panurginus cressoniellus* Cockerell**

COLORADO: 2 ♀, Ward, about 9300 ft. alt. near town, August 9, 1919; 2 ♀, Pagosa Springs, one along west bank of river below town, about 7200 ft. alt., and one in U. S. Forest, about 7400 ft. alt., June 21-24, 1919.

The female flagellum is mainly ferruginous beneath.

***Panurginus cressoniellus* variety *calochorti* Cockerell**

COLORADO: 39 ♀, 17 ♂, Tennessee Pass, about 10,300 ft. alt., July 30-August 8,¹ various collectors; 5 ♀, Ouray, about 10,000 ft. alt., on the Summit Road, July 13, 1919, collected by Messrs. Schwarz and Lutz; 1 ♀ (first recurrent vein considerably basad of the first transversocubital), Malta, about 10,000 ft. alt., August 4, 1919; 1 ♂, Elbert Creek, La Plata County, about 10,200 ft. alt., June 30, 1919; 5 ♀, Estes Park, about 7700 ft. alt., July 19, 1916, collected by A. E. Butler.

¹Females abounded at the beginning of August, males appeared about a week later.

The female flagellum is dark. The Ward specimens of *P. cressoniellus* cited above come from almost exactly the type locality of variety *calochorti*. The *calochorti* form is the prevalent one in Colorado, especially at high altitudes.

About half the Tennessee Pass specimens have the first recurrent nervure more or less basad of the first transversocubital, and so should fall with the form named *verus*. The original type of *P. verus* Cockerell distinctly differs in some other respects, especially in having the upper apical corner of marginal cell rounded, the cell not sharply truncate as in all these Colorado insects. It is quite certain that the bees here referred to *calochorti* all belong together, but as among this large series I cannot match the type of *P. verus*, it remains at least possible that the latter represents a different species, not including the specimens later referred to it. See also Entomological News, XXIII (1912), p. 445, where it was assumed that the later discovered specimens were properly referred to *verus*.

***Panurginus lutzæ*, new species**

COLORADO: 1 ♀, La Junta, along the road between irrigated fields, near to wn about 4100 ft. alt., August 12, 1920, collected by Mrs. F. E. Lutz.

♀.—Length about 6.4 mm. Black, without light markings, excepting pale yellow dots on anterior and middle knees. Thorax above with abundant, stiff, erect pale brown pubescence, not hiding the surface; vertex with similar pale brownish hair. Head ordinary, shining, facial quadrangle broader than long; tufts of whitish hair at extreme sides of clypeus below; mandibles dark, reddened subapically, simple, somewhat elbowed externally, the apical part of the right one densely rugosopunctate above; labial palpi rather short, the second joint not much longer than the third; process of labrum very broad, subtruncate, the margin gently rounded; clypeus and adjacent parts highly polished, with sparse punctures; clypeus with a large but shallow circular median depression; facial foveæ with the upper end diverging from the orbits; flagellum dusky reddish beneath except at base. Mesothorax and scutellum shining, without evident punctures under a lens, though the microscope shows that the numerous hairs arise from small punctures; metathorax shining, the basal area reduced to a narrow transverse rugulose channel; tegulae reddish-testaceous. Wings hyaline, very faintly brownish; stigma large, solid reddish brown, nervures pale brown; first recurrent joining second submarginal cell at a distance from its base much greater than half length of first transversocubital. Legs ordinary, with pale hair, middle basitarsi comparatively short and broad. Abdomen shining, the apex with white hair.

On account of characters of sculpture and wings, it does not seem possible that this is the female of *P. expallidus* Swenk and Cockerell or *P. horizontalis* Swenk and Cockerell, described from males collected in Nebraska. In many respects, it resembles *P. piercei* Crawford, but the latter is considerably larger, with much lighter and redder stigma. I

take it that *P. lutzæ* is a comparatively recent segregate from the *piercei* type, adapted to a different flower. Compared with *P. innuptus* Cockerell, the area of metathorax and other characters are quite distinctive.

***Panurginus pulchricornis*, new species**

COLORADO: 1 ♀, Tennessee Pass, about 10,500 ft. alt., August 6-8, 1920.

♀.—Length about 7 mm. Black, similar to *P. atricornis* Cresson, but the flagellum is ferruginous beneath except at base and apex, and the stigma is piceous, appearing black by reflected light. The process of labrum is broad, truncate, with the margin gently convex; in *atricornis* it is much narrower. The clypeus is very coarsely punctured though shining, without any smoother space in middle. The mesothorax and tegulae are as in *atricornis*, but the thorax is considerably smaller. The area of metathorax is rather larger, entirely rugulose and opaque. The wings are conspicuously dusky. The apical plate of the abdomen is long, with straight sides.

***Panurginus ineptus*, new species**

COLORADO: 1 ♀, Tennessee Pass, about 10,500 ft. alt., August 6-8, 1920.

♀.—Length hardly 6 mm. Black, the head and thorax with scanty but long white hair; eyes dark gray; facial quadrangle somewhat broader than long, orbits converging a little below; mandibles reddened about middle; process of labrum broad and truncate; palpi and tongue short. Third antennal joint unusually short, not much longer than broad, and not as long as the next two together, though they are very short; flagellum dusky red beneath, including the last joint. Clypeus highly polished, with scattered punctures; supraclypeal area shining; vertex smooth, with very feeble punctures. Mesothorax shining, with very weak punctures, median groove strong; area of metathorax dull and granular, the heavy posterior rim feebly shining; mesopleura dullish above, more shining below; tegulae piceous with a large pallid discal area. Wings brownish hyaline, stigma and nervures dilute reddish brown; stigma robust; marginal cell broadly, obliquely truncate, the angles not rounded; first submarginal cell much longer than second; first recurrent nervure going only just beyond the first transversocubital. Legs black, with pale hair, that on anterior basitarsi thick and pale straw-yellow. Abdomen highly polished, shining throughout, with only scattered very minute piliferous punctures; apex with shining white hair.

An isolated species.

***Hypomacrotera callops* Cockerell and Porter**

COLORADO: 2 ♀, Regnier, Baca County, about 4400 ft. alt., in Gallinas Canyon, at *Quincula lobata*, June 8, 1919.

***Hypomacrotera callops persimilis* Cockerell**

ARIZONA: 2 ♀, 2 ♂, San Xavier Mission, near Tucson, on flood-plains of Santa Cruz, at *Physalis angulata*, July 24, 1916.

The eyes are dark brown in both sexes; in typical *persimilis* from Phoenix, Arizona, they are blue-green in both sexes. The supraclypeal mark of the male is well-developed.

Greeleyella beardsleyi Cockerell

GOLORADO: 2 ♂, 11 ♀, Regnier, Baca County, about 4400 ft. alt., at *Quincula lobata*, *Sphæralcea coccinea*, and *Monarda pectinata*, June 6-9, 1919.

According to my experience, this species is oligotropic on *Malvastrum coccineum* (*Sphæralcea coccinea* of Rydberg).

The following key will facilitate the separation of the species recorded above.

- | | |
|---|--|
| Males..... | 1. |
| Females..... | 13. |
| 1. Light color of face confined to clypeus..... | 2. |
| Light color of face not confined to clypeus..... | 4. |
| 2. Tibiæ red and yellow; first recurrent nervure meeting first intercubitus. | |
| <i>G. beardsleyi</i> Cockerell. | |
| Tibiæ black, or at most anterior ones pale in front..... | 3. |
| 3. First recurrent nervure going far beyond first intercubitus; mesothorax dullish. | |
| <i>P. bakeri</i> Cockerell. | |
| First recurrent meeting first intercubitus, or falling basad of it; mesothorax polished..... | <i>P. cressoniellus</i> Cockerell. |
| 4. Supraclypeal mark wholly absent; labrum black, flagellum dark..... | 5. |
| Supraclypeal mark at least represented by a spot..... | 6. |
| 5. Larger; clypeus with two black spots; upper corner of lateral face-marks forming a larger angle..... | <i>P. porterae</i> Cockerell. |
| Smaller; clypeus without black spots; upper corner of lateral face-marks forming a smaller angle..... | <i>P. porterae</i> Cockerell, variety (Arizona). |
| 6. Anterior wings with conspicuous apical cloud; head very broad. | |
| <i>H. callops persimilis</i> Cockerell. | |
| Anterior wings without such a cloud..... | 7. |
| 7. Scape yellow in front..... | 8. |
| Scape wholly black..... | 9. |
| 8. Face chrome-yellow..... | <i>P. irregularis</i> Cockerell. |
| Face pale primrose-yellow..... | <i>P. nebrascensis</i> Crawford. |
| 9. Flagellum clear reddish orange beneath, except at base and apex. | |
| <i>P. perlævis</i> (Cockerell). | |
| Flagellum dark or dusky beneath..... | 10. |
| 10. Lateral face-marks forming practically right angles on orbits above. | |
| <i>P. piercei</i> Crawford. | |
| Lateral face-marks ending above in acute angles..... | 11. |
| 11. Anterior tibiæ dark..... | 12. |
| Anterior tibiæ light in front; eyes green..... | <i>P. didirupa</i> Cockerell. |
| 12. Small joints of tarsi red..... | <i>P. atricornis</i> (Cresson). |
| Small joints of tarsi more slender, not red..... | <i>P. altissimus</i> Cockerell. |
| 13. (Females) A light patch in middle of face; tarsi ferruginous. | |
| <i>P. renimaculatus</i> Cockerell. | |

- No light patch on face.....14.
14. Anterior tibiae pale yellowish red in front; flagellum red beneath.
G. beardsleyi Cockerell.
- Anterior tibiae dark in front.....15.
15. Mandibles bright red in middle; mesothorax highly polished; stigma very slender, pale with dusky margin.....*H. callops* Cockerell and Porter.
- Mandibles dark, or if partly reddened, mesothorax or stigma different....16.
16. First recurrent nervure joining first intercubitus, or falling basad of it.....17.
- First recurrent nervure going beyond first intercubitus.....18.
17. Flagellum red beneath.....*P. cressoniellus* Cockerell.
- Flagellum entirely dark.....*P. cressoniellus calochorti* Cockerell.
18. Mesothorax dull or dullish, not highly polished; smallish species.....19.
- Mesothorax polished; mainly larger species.....21.
19. Tegulae rufotestaceous.....20.
- Tegulae piceous.....*P. bakeri* Cockerell.
20. Clypeus and supraclypeal area punctured, dullish; stigma very dark.
P. opaculus Cockerell.
- Clypeus and supraclypeal area highly polished; stigma dilute brown.
P. pernilens Cockerell.
21. Mesothorax with conspicuous fulvous hair; tegulae rufotestaceous.....22.
- Mesothorax without such hair.....23.
22. Larger; mesothorax with conspicuous punctures.....*P. porterae* Cockerell.
- Smaller; mesothorax without conspicuous punctures....*P. lutzæ* Cockerell.
23. Flagellum black; mesothorax highly polished, without conspicuous punctures; stigma dark brown; wings strongly dusky.....*P. atricornis* (Cresson).
- Flagellum at least largely pale beneath, or if somewhat dusky, mesothorax evidently punctured.....24.
24. Stigma reddish brown, large and broad; flagellum light yellowish-ferruginous beneath, except base and apex; base of metathorax distinctly plicatulate.
P. perlævis (Cockerell).
- Stigma more slender, dark or reddish; flagellum dusky beneath, or if paler, mountain forms, smaller than *perlævis*, with base of metathorax granular.25.
25. Stigma piceous; first recurrent nervure going far beyond first intercubitus; flagellum red beneath except at ends.....*P. pulchricornis* Cockerell.
- Stigma rather dilute brown.....26.
26. First recurrent going only just beyond first intercubitus; flagellum pale beneath; rather small species.....*P. ineptus* Cockerell.
- First recurrent going considerably beyond first intercubitus.....27.
27. Mesothorax hardly at all punctured; sides of face shining, feebly punctured.
P. altissimus Cockerell.
- Mesothorax evidently punctured; sides of face distinctly punctured.
P. didirupa Cockerell.

AMERICAN MUSEUM NOVITATES

Number 37

April 25, 1922

59.6,88H (1183:78.2)

HESPEROPITHECUS, THE FIRST ANTHROPOID PRIMATE FOUND IN AMERICA

By HENRY FAIRFIELD OSBORN

It is hard to believe that a single small water-worn tooth, 10.5 mm. by 11 mm. in crown diameter, can signalize the arrival of the anthropoid Primates in North America in Pliocene time. We have been eagerly anticipating some discovery of this kind, but were not prepared for such convincing evidence of the close faunal relationship between eastern Asia and western North America as is revealed by this diminutive specimen. The entire credit for the discovery belongs to Mr. Harold J. Cook, consulting geologist, of Agate, Nebraska, who has been contributing for many years to our knowledge of the extinct fauna of Nebraska through both his discoveries and his writings. He wrote to the present author (February 25, 1922):

I have had here, for some little time, a molar tooth from the Upper, or Hipparion phase of the Snake Creek beds, that very closely approaches the human type. It was found associated with the other typical fossils of the Snake Creek, and is mineralized in the same fashion as they are. I sent a brief description of this to Professor Loomis a short time before the Amherst meeting of this year, with a request that it be read at that time, if opportunity offered. The manuscript was returned to me here immediately after the meetings, but with no notation as to whether it was read or not, or presented at that time in any fashion.

Inasmuch as you are particularly interested in this problem and, in collaboration with Dr. Gregory and others, are in the best position of anyone to accurately determine the relationships of this tooth, if it can be done, I will be glad to send it on to you, should you care to examine and study it. Whatever it is, it is certainly a contemporary fossil of the Upper Snake Creek horizon, and it agrees far more closely with the anthropoid-human molar, than that of any other mammal known.

On receiving the tooth, the author telegraphed (March 14, 1922): "Tooth just arrived safely. Looks very promising. Will report immediately." A letter followed the same day:

The instant your package arrived, I sat down with the tooth, in my window, and I said to myself: "It looks one hundred per cent anthropoid." I then took the tooth into Doctor Matthew's room and we have been comparing it with all the books, all the casts and all the drawings, with the conclusion that it is the last right upper molar tooth of some higher Primate, but distinct from anything hitherto described. We await, however, Doctor Gregory's verdict tomorrow morning; he certainly has an eagle eye on Primate teeth. . . . We may cool down tomorrow, but it looks to me as if the *first anthropoid ape of America* had been found by the one man entitled to find it, namely, Harold J. Cook!

On March 22, 1922, the author wrote:

We believe we have found another one of the teeth, very much worn, of the same animal, which, so far as it goes, is confirmatory. The animal is certainly a new genus of anthropoid ape, probably an animal which wandered over here from Asia with the large south Asiatic element which has recently been discovered in our fauna by Merriam, Gidley and others. It is one of the greatest surprises in the history of American palæontology and I am delighted that you are the man who found it. Our specimen is unrecognizable, it is so much worn.

The tooth arrived with the following label:

One Molar Tooth, ?Anthropoid, No. HC425, Collection of Harold J. Cook, Agate, Nebraska. Found in Upper Phase of Snake Creek Beds, Typical Locality, in position in gravels with other fossils.

Following the examination by Dr. William D. Matthew and the author, who determined the tooth as a second or third upper molar of the right side of a new genus and species of anthropoid, the tooth was submitted to Curator William K. Gregory and Dr. Milo Hellman, both of whom have made a special study of the collections of human and anthropoid teeth in the American Museum and the United States National Museum. They reported (March 23, 1922) as follows:

1. Such a degree of wear is very rarely seen on m^3 , and in view also of the marked difference in form of m^4 , we rather incline to the opinion that it is an m^2 . 2. The kind of wear shown in this tooth, which has an evenly concave surface (without humps representing the para- and metacones), has never been seen in an anthropoid tooth, and we are of the opinion that even in very old chimpanzees the outer half of the crown will be unevenly worn. 3. The nearest in point of wearing surface is the supposed m^2 attributed to *Pithecanthropus*, also in form of roots. The strong hypocone in "*Pithecanthropus*" and the absence of hypocone in the new specimen is not positively diagnostic, in view of the immense differences in the hypocone, both in apes and man. 4. On the whole, we think its nearest resemblances are with "*Pithecanthropus*" and with men rather than with apes.

On the basis of these very careful studies, the author decided to make this tooth the type of the following new genus and species.

***Hesperopithecus haroldcookii*,¹ new species**

This second upper molar tooth is very distant from the gorilla type, from the gibbon type, from the orang type; among existing anthropoid apes it is nearest to m^2 of the chimpanzee, but the resemblance is still very remote. It is excluded from close affinity to the fossil Asiatic anthropoid apes, such as *Dryopithecus punjabicus*, *Palæopithecus sivalensis*, and *Siwapithecus*, recently related to the human stem by Pilgrim. Its transverse diameter of 11 mm. is greater than its anteroposterior diameter of 10.5 mm. In the corresponding human tooth, m^2 , of an American Indian, with which it is compared in Fig. 2, the transverse diameter is 12.5 mm., the anteroposterior

¹The names signify an anthropoid of the Western World discovered by Mr. Harold J. Cook.

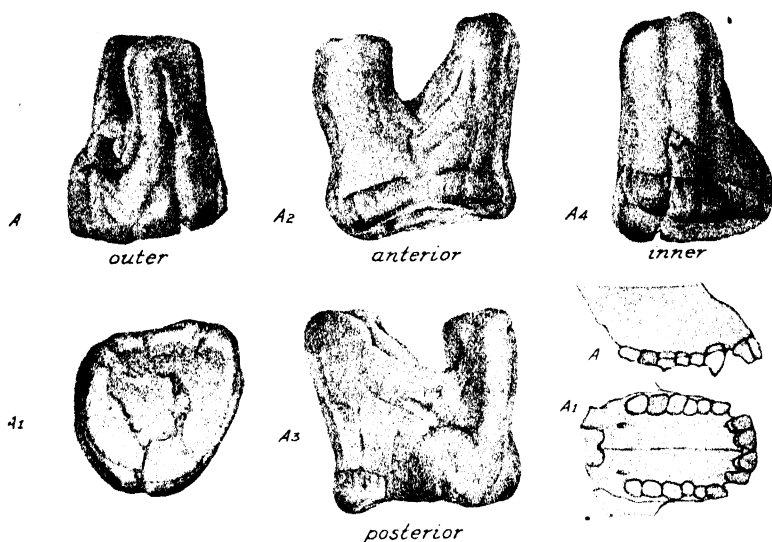


Fig. 1. Type of *Hesperopithecus haroldcookii*, No. HC425, Collection of Harold J. Cook, Agate, Nebraska. From the Snake Creek beds, Sioux County, Nebraska. After a drawing of the type tooth in five aspects by Mrs. L. M. Sterling. Enlarged to twice the natural size.
A, A1 Palate of chimpanzee, m² shaded.

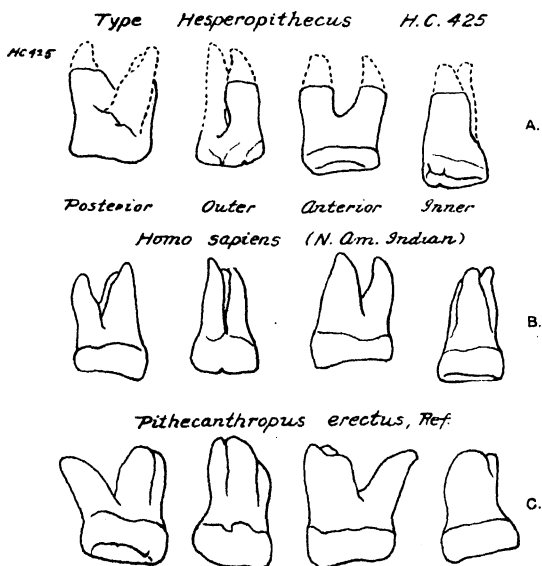


Fig. 2. Comparison of the superior molar teeth of *Hesperopithecus* type, of *Homo sapiens*, of *Pithecanthropus erectus* ref., to show the similar disposition of the inner and outer fangs. Teeth not drawn to the same scale.

diameter is 11 mm. Thus the proportions of the molar crown of the *Hesperopithecus* type are about the same as those in the *Homo sapiens mongoloideus* type. There is also a distant human resemblance in the molar pattern of *Hesperopithecus*, as very skilfully portrayed (Fig. 1) by the artist, Mrs. L. M. Sterling, to the low, basin-shaped, channeled crown in certain examples of *Homo sapiens*. But the *Hesperopithecus* molar cannot be said to resemble any known type of human molar very closely. The author agrees with Mr. Cook, with Doctor Hellman, and with Doctor Gregory, that it resembles the human type more closely than it does any known anthropoid ape type; consequently it would be misleading to speak of this *Hesperopithecus* at present as an anthropoid ape; it is a new and independent type of Primate, and we

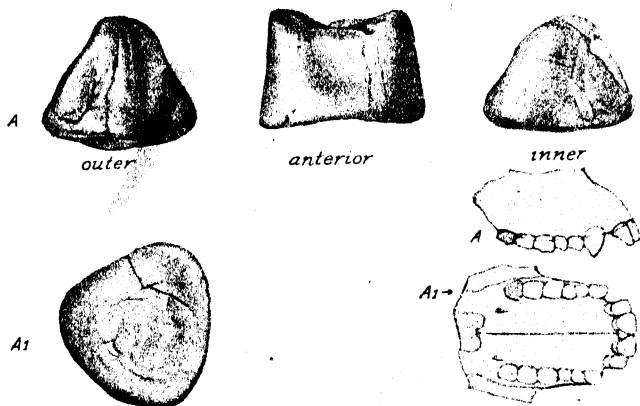


Fig. 3. Superior molar tooth from Snake Creek, Nebraska, Amer. Mus. No. 17736, Collection from Amer. Mus. Exped. of 1933. Found by William D. Matthew. Provisionally regarded as m¹ of *Hesperopithecus*. Species indeterminate. Enlarged to twice the natural size.
A, A₁ Palate of chimpanzee, m¹ shaded.

must seek more material before we can determine its relationships. It is certainly not closely related to *Pithecanthropus erectus* in the structure of the crown, for *Pithecanthropus* has a single, contracted crown in which the superior grinding surface has a limited crenulated basin, whereas *Hesperopithecus* has a widely open crown with broadly channeled or furrowed margins, and a postero-internal crest suggesting the hypocone of a higher Primate form. The disposition of the roots in *Hesperopithecus*, in *Homo*, in *Pithecanthropus*, is shown to be very broadly similar in comparative Fig. 2. The *Hesperopithecus* molar is three-fanged, the postero-external fang having been broken off in the type; the internal fang shows a median internal groove and a tendency to a deep external groove on the outer side.

Since 1908 there has been in the American Museum collection from this same horizon another small water-worn tooth, discovered by Dr. William D. Matthew. The specimen belonged to an aged animal and is so water-worn that Doctor Matthew, while inclined to regard it as a Primate, did not venture to describe it. It now appears, from close comparison with the type of *Hesperopithecus*, to be closely related generically, even if it is not related specifically. The greatly enlarged drawing

(Fig. 3), reproduced to the same scale as that of the type above described, shows that the molar pattern is fundamentally similar. The crown differs in its much more triangular form and, were it not for its extremely worn surface, we should unhesitatingly pronounce it as a third superior molar; it has, therefore, been given this position provisionally in the diagram; it seems to confirm the opinion of Gregory and Hellman that the type of *Hesperopithecus* is a second superior molar.

The geologic age of these two specimens is now believed to be the same as that of Thousand Creek, Nevada, and Rattlesnake, Oregon, among the fauna of which *Pliohippus* is very abundant and varied; it also contains *Ilinoeceras* and other strepsicerine antelopes of Asiatic affinity; it is the last American fauna in which occurred the rhinoceros, preceding the Blanco fauna in which the Asiatic brevirostrine *M. mirificus* first occurs.

59.7,55L (51.1)

DESCRIPTION OF A NEW LOACH FROM NORTH-EASTERN CHINA

By HENRY W. FOWLER

Lefua andrewsi,¹ new species

Head $4\frac{3}{8}$; depth 7; D. II, 6; A. II, 6; P. I, 12; V. I, 6; scales about 104 in a median lateral series; head width about $1\frac{3}{4}$ in its length; head depth 2; snout $3\frac{3}{8}$; eye $4\frac{7}{8}$; maxillary $3\frac{3}{4}$; interorbital $3\frac{1}{10}$; depressed dorsal $1\frac{1}{4}$; depressed anal $1\frac{1}{8}$; least depth of caudal peduncle 2; caudal length $1\frac{1}{10}$; pectoral $1\frac{1}{8}$; ventral $1\frac{1}{4}$.

Body elongate, moderately slender, considerably depressed forward and becoming compressed posteriorly, edges all convex except slight keel forward above and below on caudal peduncle by rudimentary caudal rays to caudal base. Caudal peduncle strongly compressed, least depth little less than its length.

Head moderate, robust, broadly depressed, especially behind. Snout broad, obtuse, length $\frac{3}{4}$ its width. Eye small, hind edge about midway in head length. Maxillary small, about half-way to eye. Jaws even. Lips rather thin. Nasal barbel reaches eye center. Maxillary barbel to hind eye edge. Upper lateral barbel to eye center. Interorbital broadly though slightly convex.

Gill-opening lateral, long as snout.

Scales all small, not overlapping, in rather irregular distribution though close-set and with imbedded appearance; marginal radiating striæ 31 to 37; circuli moderately fine. No developed lateral line.

Dorsal origin little nearer that of pectoral than to caudal base, depressed fin slightly less than caudal base. Anal inserted little behind dorsal base, though little before depressed dorsal tip, depressed fin three-fourths to caudal base. Caudal rounded, median rays longest. Pectoral about half-way to ventral. Ventral reaches about three-fourths to anal. Vent close before anal.

Color in alcohol nearly sepia above, dusted very obscurely with darker. Dusky lateral band, rather obscurely defined, from each side of snout tip to eye, though below and over infraorbitals, back to caudal base. Posteriorly band much darker to blackish. Dark vertebral line on predorsal, slightly so behind dorsal. Barbel edges and lip margins dusky. Iris pale slaty. Dorsal and caudal grayish, both finely and obscurely spotted with dull dusky, only a distinct median black blotch on latter, reflected out on median rays basally. Other fins all pale, pectorals with few shadings.

Length, 52 mm.

Type, No. 7974, American Museum of Natural History. Shing Lung Shan, Eastern Tombs, China. August 7, 1921. Collected by The Third Asiatic Expedition of The American Museum of Natural History.

¹In recognition of Mr. Roy Chapman Andrews, leader of the Third Asiatic Expedition of The American Museum of Natural History.

This species is closely related to *Lefua costata* (Kessler) and appears to differ only in the color-pattern. Apparently the two forms occur associated, as they were received in the same lot. In *Lefua andrewsi* the broad and well-defined lateral band of dusky to blackish, which is reflected out on the median caudal rays, is diagnostic. In *Lefua costata* the scarcely evident lateral streak is replaced at the caudal base by a definite small rounded black spot, clearly defined and not reflected out on the median fin-rays.

AMERICAN MUSEUM NOVITATES

Number 39

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59.51,22S (7)

TWO NEW GENERA OF NORTH AMERICAN BLOOD FLUKES¹

BY HORACE W. STUNKARD

For a long time the writer has been engaged in a study of the blood flukes of North American turtles. An extended description of these forms is nearing completion but, since the publication of the longer paper may be delayed, the discovery of two new trematodes found in the vascular system of the snapping turtle *Chelydra serpentina* is announced at this time. These blood flukes are so unlike all previously described forms that they can not be assigned to any existing genera and differ so much from each other that they can not be included in the same genus.

SPIORORCHIDÆ

The family Spiororchidæ has the following characteristics.

Slender blood-inhabiting trematodes, with slightly developed musculature and one or two weak suckers. Pharynx absent. Testes lobed, multiple, anterior and sometimes also posterior to the ovarian complex. Ovary lobed; Laurer's canal present; uterus short. Eggs large, thick-shelled, discharged singly.

HAPALOTREMINÆ

The subfamily Hapalotremiæ is characterized as follows.

Hermaphroditic, blood-inhabiting distomes. Esophagus often with dilated portion or portions, without a pharynx, and surrounded by secretive cells. Ceca end blindly near the posterior end of the body. Excretory vesicle branches behind the posterior testes. Ovary and oötype situated near the middle of the body and between the testes; genital pore dorsal and sinistral near the level of the ovary; vitellaria numerous, both lateral and medial to the ceca throughout most of their course; Laurer's canal present; uterus short containing a single egg which bears either filaments or processes.

HAPALORHYNCHUS, new genus

This genus is characterized by the presence of a protruding oral sucker; acetabulum situated near the posterior end of the anterior third of the body; terminal excretory pore and short median excretory vesicle; testes separated by the ovary; large seminal vesicle and prostate gland anterior to the testes; dorsal genital pore located near the middle of the body and slightly left of the median line; vitellaria extensively developed in front of the acetabulum and behind the ovary; small seminal receptacle and Laurer's canal; and also by the absence of a pharynx, cirrus sac and cirrus.

¹Contribution from the Biological Laboratory, New York University.

***Hapalorhynchus gracilis*, new species**

Figures 1 and 2

The material upon which this description is based consists of over one hundred individuals collected from the washings of the visceral organs, lungs, liver, kidneys, mesenteries, and alimentary tract of turtles from North Judson, Indiana.

Fixed and mounted specimens measure from 1.5 to 1.9 mm. in length and from 0.15 to 0.23 mm. in width. Living specimens in an extended condition are slightly longer and more slender. The worms are fusiform in shape tapering anteriorly and posteriorly in a similar manner. The region of greatest width is near the middle of the body where the reproductive organs are located. Before and behind the limits of the vitellaria the body narrows considerably. In cross-section the body is oval, flattened ventrally.

The cuticula is thin and unarmed. The musculature is weak and poorly developed.

The acetabulum is slightly protrusible but not stalked and is situated near the posterior end of the anterior third of the body. It is cup-shaped, normally circular in outline but sometimes elongated or flattened as a result of pressure or contraction. It measures from 0.061 to 0.069 mm. in diameter and its depth is approximately equal to its diameter.

The oral sucker is slightly subterminal and capable of considerable extension and retraction. In fixed and mounted specimens, usually about one-half of the sucker protrudes from the body. In shape it is ovate, wider anteriorly and measures from 0.073 to 0.084 mm. in length and from 0.054 and 0.058 mm. in extreme width. The esophagus extends posteriorly from the oral sucker to the bifurcation of the alimentary tract midway between the oral and ventral suckers. It is straight in extended specimens, often with two or three dilated portions. The lining is cuticular and it is surrounded by secretive cells. No pharynx is present. The digestive ceca meet anteriorly to form an angle and end blindly about one-fifth of the body length from the posterior end. They are somewhat dorsal in position and the left crux is flexed median and dorsad near the middle of the body, passing on the median side of the genital pore.

The excretory pore is located at the posterior end of the body and a large median collecting vesicle passes forward dividing a short distance behind the intestinal crura to form two lateral collecting ducts.

The testes are situated one behind and the other before the ovary. The posterior testis is the larger; it has an elongated oval form and measures 0.18 to 0.21 mm. in length, 0.05 to 0.06 mm. in width and 0.06 to 0.07 mm. in depth. The anterior testis is situated obliquely, immediately in front and slightly at the right of the ovary. It is ovate to triangular in outline, the widest portion is anterior and median and the organ narrows laterally and posteriorly. The posterior end occupies the right side of the body at the ovarian level. Its long axis measures from 0.064 to 0.084 mm. and its transverse axis 0.04 to 0.05 mm.

There is a large seminal vesicle which extends from the level of the acetabulum about one-half of the distance posteriad to the ovary. On the right side it has an indentation and is partially covered by a lobe of the vitellaria. From the median

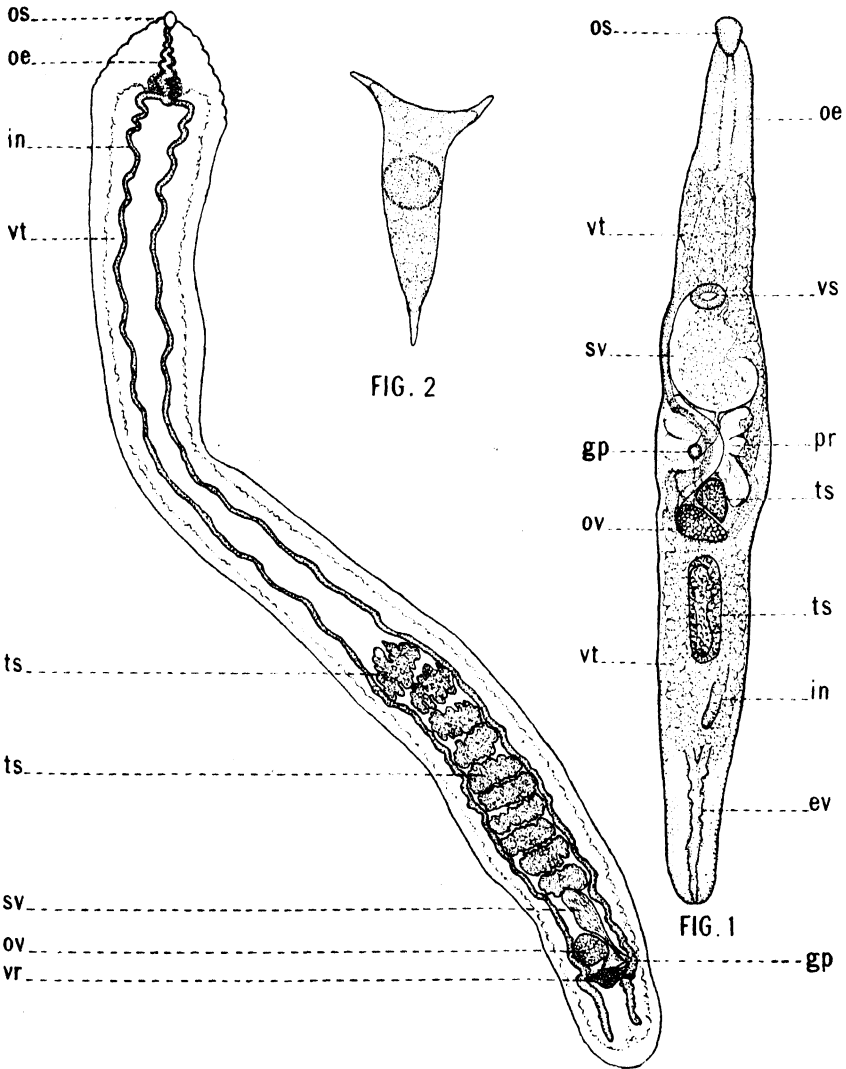


FIG. 3

Fig. 1. *Hapalorhynchus gracilis*, dorsal view. *Ev*, excretory vesicle; *gp*, genital pore; *in*, intestine; *oe*, esophagus; *os*, oral sucker; *ov*, ovary; *pr*, prostate; *sv*, seminal vesicle; *ts*, testis; *vr*, vitelline receptacle; *vs*, acetabulum; *vt*, vitellaria.

Fig. 2. Egg of *Hapalorhynchus gracilis*.

Fig. 3. *Henotosoma haematobium*, ventral view. Abbreviations as for *Hapalorhynchus gracilis*.

posterior margin of the vesicle the vas deferens emerges as a small tube. It enlarges almost immediately and passes posteriad, dorsad and sinistrad to the genital pore. The anterior part is often filled with spermatozoa while the terminal part is usually empty. This terminal part is lined with cuticula and contracts to a small duct which opens to the surface just median and anterior to the opening of the uterus. The pore is double, the male and female canals opening separately although the wall separating them is very thin and they appear to discharge through a common orifice. A cirrus sac and cirrus are lacking. The vas deferens and the terminal part of the seminal vesicle are enclosed in a large prostate gland which occupies most of the body space between the anterior testis and the seminal vesicle.

The ovary is situated slightly at the left of the median line and posterior to the middle of the body. Its long axis is almost at right angles to the long axis of the worm. It measures from 0.1 to 0.12 mm. in length and from 0.06 to 0.08 mm. in extreme width. It is ovoid to pyriform in shape, the wider end is lateral and slightly anterior, and the oviduct arises at the median posterior margin. The oviduct passes posteriad almost to the level of the posterior testis. Here it gives off a small seminal receptacle and Laurer's canal passes dorsally opening to the surface near the median line. Immediately following the origin of Laurer's canal, the vitelline duct discharges into the oötype and the canal then passes forward on the dorsal side of the body and leads directly to the genital pore. The vitellaria consist of masses of follicles extending on either side of the body from the bifurcation of the alimentary tract to the bifurcation of the excretory vesicle. They extend to the median line forming a solid mass in front of the acetabulum and behind the ovary except for a small area where the posterior testis occupying almost all the space between dorsal and ventral walls of the body limits their presence. Between the acetabulum and the ovary they are restricted to narrow tracts at the sides of the body lateral to the intestinal diverticula.

The genital pore is dorsal in position, situated near the middle of the body, slightly at the left of the median line. The diverticulum of the intestine and the vitelline tube of that side are bent mediad at the level of the pore, and lie median to it. This condition suggests strongly that the genital pore has migrated from a ventrolateral or lateral to a dorsal position pushing the intestinal and vitelline structures before it.

The uterus is short and in only one out of many individuals examined has an egg been found in the body. Considering the size of the egg it appears certain that not more than a single egg can be present in the uterus at one time. The egg (Fig. 2) is tricornuate, the shell is thick and resistant to pressure although almost colorless. In the body the egg lies in the uterus with the single horn forward and the forward tip is often bent or slightly coiled. The eggs reach the outside world with the feces of the host and are often present in large numbers. Eggs in the feces measured 0.27 mm. in length, 0.07 mm. in width at the level of the embryo and 0.2 mm. between the tips of the posterior horns.

Holotype.—No. 125, Dept. Lower Invertebrates, Amer. Mus. Nat. Hist.

SPIRORCHINÆ

The subfamily Spirorchinæ is characterized as follows.

Hermaphroditic blood inhabiting monostomes with small oral sucker. Esophagus without pharynx and surrounded by secretive cells which are more numerous near its posterior end. Ceca end blindly near posterior end of body; excretory

vesicle small, dividing almost immediately into lateral collecting ducts. Testes numerous (usually ten) arranged in a linear series in the intercecal area anterior to the ovary; cirrus sac small; ovary dextral in position between the testes and the genital pore; seminal receptacle and Laurer's canal present; vitellaria both extra and intercecal; genital pore ventral, sinistral, near the posterior end of body; uterus short, containing a single oval egg.

Henotosoma, new genus

This genus is characterized by the small oral sucker and relatively short esophagus; absence of pharynx; terminal excretory pore and excretory vesicle which divides almost immediately to form lateral collecting ducts; testes usually ten in number, irregularly lobate or sinuate, arranged in linear series anterior to the ovary but situated in the posterior half of the worm; seminal vesicle posterior to the testes with only the terminal part of the vas deferens enclosed in a small cirrus sac; genital pore ventral, sinistral, near the posterior end of the body; vitellaria numerous, extending from the bifurcation of the alimentary tract almost to the posterior end of the body; ovary oval, lobed, on the right side of the body; small seminal vesicle and Laurer's canal. The uterus is short and contains a single oval egg.

Henotosoma hæmatobium, new species

Figure 3

The first specimen of this form was found December 1, 1914, in the lung of a large turtle collected near Raleigh, North Carolina. In the fall of 1916, six specimens were removed from the left subclavian artery of another turtle from the same locality. Since that time other specimens have been removed from the heart and larger arteries of turtles collected in New York and New Jersey. In November, 1921, a shipment of turtles was received from North Judson, Indiana, seventy-five per cent of which harbored the parasite. Records of dissection show one turtle in which twelve specimens were found in the lungs, four in the pulmonary arteries, two in each auricle, sixteen in the ventricle, eight in the mesenteric arteries and twenty eight at the posterior end of the aorta. Where several worms were found together, they were often entangled and very hard to separate. Those found in the ventricle frequently were partially embedded in the muscular wall.

These worms are elongate, flattened trematodes with almost parallel sides, rounded posterior and pointed anterior ends. The anterior end in extended condition narrows uniformly to the tip and when contracted becomes broad and blunt with crenated margins. Extended individuals are widest in the region occupied by the testes and have a narrow zone in the central part of the body. On contraction, the body anterior to the testes becomes approximately the width at their level. Living worms may extend to a length of 12.5 mm. and contract to less than 6 mm. Fixed and mounted specimens measure from 5 to 9 mm. in length and from 0.48 to 0.75 mm. in width. The width is from two to three times the dorso-ventral measurement.

The cuticula is thin and smooth, lacking spines or other modifications. The musculature is light and delicate.

The oral sucker is the only organ of attachment. It is situated at the anterior tip and in extended specimens slightly protrudes from the body. It is ovoid in shape, wider anteriorly and measures from 0.077 to 0.1 mm. in length and from 0.071 to 0.084 mm. in width. The mouth opening is subterminal. Depending on the amount of contraction in the anterior region of the body, the esophagus is slightly or exceedingly sinuous, the sinuosity varying with the extent of contraction. In length it measures from 0.39 to 0.77 mm. It increases in diameter posteriorly although the size of the lumen is not uniform, frequently having one or more dilated portions. The lining is cuticular and throughout its length the esophagus is surrounded by secretive cells. At the posterior end for about one-fifth of its length the gland cells become more numerous forming a conspicuous enlarged portion. No pharynx is present. The intestinal diverticula arise just before the posterior end of the esophagus and pass laterad about one-half of the distance to the body wall where they turn sharply posteriad and extend almost to the end of the body. Their course is notably sinuous and they are spread farther apart in the region occupied by the reproductive organs, passing lateral to the testes and ovary. They have an almost uniform diameter and are filled with decomposing blood which gives them a black appearance.

The excretory pore is situated at the posterior end of the body and the vesicle divides almost immediately to form two lateral collecting ducts which pass anteriorly.

The reproductive organs resemble in many respects those of *Spirorchis*. The testes number ten in mature individuals although after a time certain testes degenerate. They are arranged one before the other in the intercecal area in the posterior half of the body. The most anterior testis is about three-fifths of the body length from the anterior end and the posterior testis is separated from the posterior end of the body by slightly less than one-half the distance between the anterior and posterior testes. The testes are irregularly lobed, contiguous structures. In the anterior testes the lobes are deep and the testes are distinctly separated, while in the middle of the group the lobulations are smaller, less conspicuous, and the organs closer together. The testes are flattened antero-posteriorly, and this is particularly noticeable at the center of the group where the pressure is greatest. In the testicular area they occupy practically all the space between the ceca but do not extend laterally beyond the intestinal diverticula. Because of their shape it is difficult to make satisfactory measurements of the testes but they vary in size from 0.12 by 0.27 mm. to 0.27 mm. by 0.43 mm. The posterior testis opens directly into a large ovoid or pyriform seminal vesicle. The broader end is anterior and the posterior end tapers to a duct which passes on the left side of the body and near the mid-ovarian level enters the cirrus sac. The cirrus sac is small and the muscular wall slightly developed. It is pyriform in shape, wider anteriorly, and the prostate if present is represented by only a few cells. The cirrus sac varies in length from 0.154 to 0.22 mm. and in width from 0.05 to 0.077 mm. The genital pore is ventral, just posterior to the level of the ovary, and situated beneath the cecum of the left side. The opening of the cirrus is anterior to that of the uterus.

The ovary is a lobed oval structure situated on the right side of the body between the seminal vesicle and the genital pore. It measures from 0.154 by 0.22 mm. to 0.23 by 28 mm. The oviduct arises at the median posterior margin and passes dextrad and posteriad. After continuing a short distance it turns mediad where Laurer's

canal is given off and the common vitelline duct is received. The oötype region is short and the tube then passes forward, laterad and ventrad to the genital pore. The vitellaria are extensively developed and consist of masses of follicles extending from the bifurcation of the alimentary tract almost to the posterior end of the body. They are not separated into lobes but form a continuous sheet of cells extending on the lateral side of the crura throughout their length and filling the intercecal area anterior to the testes and posterior to the vitelline receptacle. Just behind the level of the genital pore vitelline ducts pass mediad on the ventral side of the body and unite to form a large reservoir, the vitelline receptacle, which opens into the oötype through the common vitelline duct.

The uterine portion of the female canal is short and contains a single oval egg. A metraterm is present although not strongly developed. The eggs are thick shelled, brown in color and are discharged into the blood vessels. The smallest egg measured in the uterus was 0.77 mm. in length and 0.06 mm. in width, the largest 0.086 mm. in length and 0.065 mm. in width. Eggs in the tissue of the host and found in the feces have an average measurement of 0.115 mm. in length and 0.081 mm. in width. The eggs increase in size after deposition and usually become darker in color. They are provided with a cap which opens to allow the escape of the embryo.

Holotype.—No. 126, Dept. Lower Invertebrates, Amer. Mus. Nat. Hist.

In the abstracts of papers presented at the annual meeting of the American Association for the Advancement of Science, December 28-30, 1921 and published in the January number of the *Journal of Anatomy*, G. A. MacCallum reported the discovery of trematodes in the heart of *Chelydra serpentina*. He says: "On July 17, 1921, I found within the heart of a *Chelydra serpentina* (western form) five Spiroorchidæ which were attached to the walls of the ventricle, but all coiled together as if in coition. These worms were the largest of any Spiroorchidæ I had seen, being in length 8.50 to 9 mm. \times 1 mm. wide, and which I have named *S. chelydræ*. The peculiarity about these worms is the much bent esophagus, also the numerous glands at the junction of the esophagus and ceca and possibly posterior also on the outside of the esophagus to the mouth." The statement of MacCallum is so brief and indefinite that it is hardly possible to recognize a species from his description. The last sentence would indicate that the mouth is posterior, which certainly is not the case. The only data upon which a determination from his description could be based are size and location in the host. The course of the esophagus is dependent upon the amount of extension or contraction in the anterior part of the body and the esophageal glands mentioned are characteristic of blood flukes in general. Consequently these features can not serve as specific criteria.

It seemed barely possible that the species reported by MacCallum might be the same as the larger of the forms here described, and to avoid error on this point I wrote Dr. MacCallum asking for a loan of his

material. Although his final description had not as yet been published he kindly loaned material for examination and comparison. The specimens examined manifest the features designated as characteristics of the new genus *Henotosoma* and should, I believe, be assigned to that genus. They are not, however, in my opinion specifically identical with *H. hæmatobium* and their completed description will be made by Dr. MacCallum.

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NOTES ON SOME WESTERN BEES

By T. D. A. COCKERELL

The bees upon which the following notes are based were collected by the American Museum expeditions to Arizona and the Rocky Mountains. Except where otherwise stated, they were collected by Frank E. Lutz and the field notes are by him.

DIANDRENA Cockerell

This genus (or subgenus of *Andrena*) was founded on those bluish or greenish species which possess only two submarginal cells, the *Panurgus chalybæus* of Cresson being the type. Viereck has (1917) described species in *Parandrena*, but this group appears to have been derived quite independently from the *Andrena* stem. As we now know it, *Diandrena* consists of a considerable number of rather closely related species, having its center in California, with a general distribution very like that of the mariposa lilies (*Calochortus*). The following species are Californian: *chalybæa* (Cresson), *puthua* Cockerell, *beatula* Cockerell, *cyanosoma* Cockerell, *clariventris* Cockerell, *scintilla* Cockerell, *foxii* (Cockerell), *austro-californica* (Viereck), *olivacea* (Viereck), *subchalybea* (Viereck), *submæsta* (Viereck), and *parachalybea* (Viereck). The only known species which are not Californian are *nothocalaidis* Cockerell from Colorado, *chalyboides* (Viereck) from Oregon, *perchalybea*¹ (Viereck) from Washington State, and the following new one from Wyoming.

Diandrena *ablegata* new species

♀.—Length about 9.5 mm. Blue-green, varying to olive-green, with a dull and granular surface. The type has the abdomen olive-green, with the hind margins of the third and fourth segments very broadly steel-blue and the first two segments suffused with the same color apically. Process of labrum strongly emarginate. Mandibles dusky reddish apically. Clypeus closely and finely punctured. Third antennal joint a little shorter than the next three together; apical half of flagellum marked with clear yellowish-ferruginous beneath. Facial foveæ black, very short and narrow, not going below antennal line; face with thin, pale hair in middle and black at sides; cheeks with white hair. Mesothorax and scutellum dull; thorax with pale fulvous-tinted hair, very thin above; a little dark hair sometimes present about the middle of the mesopleura. Tegulæ shining black. Wings as in *D. nothocalaidis*, slightly

¹The name "*perchalybia*" in 1916, Proc. Acad. Nat. Sci. Phila., LXVIII, p. 591, is a misprint, as is shown by the references on p. 590 with the correct spelling.

dusky; stigma clear ferruginous. Legs with pale hair; scopa of hind legs abundantly pale fulvous, the tibiae posteriorly toward base with dark fuscous hair. Second abdominal segment depressed about one-third. Hair at apex of abdomen very pale fulvous, becoming fuscous at tip.

Wyoming: 7 ♀, Stewart Ranger Station (type locality) in Jackson Hole, about 6700 ft. alt., among lodgepole pine, Engelmann spruce, etc., July 18, 1920; 4 ♀ (one with deep orange pollen), Jackson, about 6300 ft. alt., moderately moist pasture-land, July 13-17, 1920.

This is so near to *D. nothocalaidis*, which flies in May, that I wondered whether it could be a pale-haired second brood of that species. Against this is the fact that *D. nothocalaidis* is very common at Boulder, Colorado, and we have never found any sign of a second generation or any other form of *Diandrena* there. *D. nothocalaidis* has the hair of face abundant and black, of pleura black, etc.

HALICTOIDES Nylander

The genus *Halictoides* was founded by Nylander in 1848 on two black European bees, of which *H. dentiventris* Nylander has been designated the type. No additions have been made to this immediate group; but Morawitz has described six species forming a series of *Halictoides* in which the body or head is more or less blue-green or blue-black and the legs of the males of the three species in which that sex is known are modified. Of these later species, *H. paradoxus* lives at high altitudes in the European Alps, *H. atocæruleus* and *H. pamirensis* occur in Turkestan; *H. calcaratus* and *H. montanus* are from China; and *H. clavicrus* is Mongolian. By the structure of the mouth-parts, *H. paradoxus* is nearer to some of the American species than to *H. dentiventris* (See *Annals and Mag. Nat. Hist.*, (7) IV, 1899, p. 420).

In America the genus is more numerously represented with over a dozen species. A table was given in 1916, *Ent. News*, XXVII, p. 62. In the same year Crawford described *H. viridescens* from California. California, with five species, and New Mexico, with six, indicate that the genus is best represented in the Southwest. One species, *H. novæangliæ* Robertson, occurs in the Northeastern States and one, *H. marginatus* Cresson, is found in the Central States from Illinois, whence Robertson described it as *autumnalis*, westward to the Rocky Mountains.

Five species were taken by the American Museum expeditions as follows.

Halictoides oryx Viereck

COLORADO: 1 ♀, Aspen, about 7900 ft. alt., at edge of town, July 24, 1919, collected by Herbert F. Schwarz.

Halictoides mülleri Cockerell

WYOMING: 1 ♂, Stewart Ranger Station in Jackson Hole, about 6700 ft. alt., among lodgepole pine, Engelmann spruce, etc., July 18, 1920.

This is a most astonishing record, *H. mülleri* being a species of southern California (Pasadena and Claremont). There is no question about the identification.

Halictoides harveyi Cockerell

COLORADO: 5 ♂, 1 ♀, about 10,000 ft. alt. on Summit Road near Ouray, July 13, 1919, collected by Messrs. Lutz, Schwarz, and Bailey; 1 ♂, Ouray, about 8000 ft. alt., at *Achillea millefolium*, July 11, 1919; 2 ♂, 4 ♀, Tennessee Pass, about 10,300 ft. alt., August 1, 1919, and 1 ♀ collected by Mrs. F. E. Lutz at about 10,500 ft. alt., August 8, 1920; 1 ♀, Leadville, about 10,200 ft. alt., August 3, 1919; 1 ♂, Pagosa Springs, about 7400 ft. alt., in the U. S. Forest Reservation, June 22, 1919.

Halictoides (Parahalictoides) maurus (Cresson)

IDAHO: 1 ♀, Victor, about 6300 ft. alt., July 11, 1920. WYOMING: 1 ♂, Thumb of Yellowstone Lake, about 7800 ft. alt., July 9, 1920; 1 ♂, Stewart Ranger Station, in Jackson Hole, about 6700 ft. alt., July 18, 1920; 1 ♂, along Cache Creek near Jackson, about 6600 ft. alt., July 14, 1920. COLORADO: at about 10,000 ft. alt., along Summit Road near Ouray, July 13, 1919, collected by Herbert F. Schwarz.

From Jackson, Wyoming, also comes a specimen of *Colletes nigrifrons* Titus, superficially exactly like *H. maurus*. Whether this resemblance has any biological significance I do not know. The *Colletes* was not found with the *H. maurus* but higher up at about 7000 ft. alt.

Halictoides (Epihalictoides) marginatus (Cresson)

COLORADO: 49 ♂, 5 ♀, Wray, about 3700 ft. alt., August 17-19, 1919, both sexes but especially males at *Helianthus*, collected by Messrs. Lutz and Bailey; 1 ♂, La Junta, about 4100 ft. alt., August 12, 1920; 5 ♂, Boulder, about 5300 ft. alt., on plains, August 7-12, 1919; 1 ♀, about 8200 ft. alt., along Castle Creek near Aspen, July 24, 1919, at *Erigeron macranthus*.

Halictoides marginatus halictulus (Cresson)

UTAH: 66 ♂, Ogden, August 30, 1916, asleep in early morning on *Helianthus* flowers. WYOMING: 1 ♂, Sheridan, collected by Dr. Metz. COLORADO: 4 ♂, Boulder, about 5300 ft. alt., on plains, August 7-12, 1919.

Typical *marginatus*, described from Kansas, has clear wings and amber stigma. I have it from Baldwin, Kansas, (Bridwell); the Wray and other specimens listed above conform with it. Cresson described *Panurgus halictulus* from Colorado and Utah, noting the dusky nervures. With the fine series now before me, I can clearly separate *halictulus* as a distinct race or subspecies having the wings dusky and the stigma dusky-ferruginous, margined with fuscous. This form is not accounted for in

the table in Entomological News, 1916. The two races meet at Boulder, a series taken on the plains west of the town consisting of three *marginatus*, four *halictulus*, and two more or less intermediate. It is, however, astonishing to find that the specimen from Aspen, high up in the mountains, is true *marginatus* with pale amber stigma. I have *halictulus* from Santa Fé, New Mexico; the specimen was compared by Mr. Fox with Cresson's type and found to agree. Contrary to expectation, a specimen from Las Cruces, New Mexico, is also *halictulus*.

CALLIOPSIS Smith

Calliopsis rhodophilus (Cockerell)

COLORADO: 1 ♀, north of Animas, near Durango, about 6600 ft. alt., June 26, 1919; 1 ♀, Ridgeway, about 7000 ft. alt., July 10, 1919.

The above were overlooked when reporting on these bees in Amer. Mus. Novitates No. 24. The Ridgeway female resembles *C. andreniformis* in possessing dog-ear marks but it has the black hair on the head and thorax above that are characteristic of *rhodophilus*. The same form was taken at Las Vegas, New Mexico, July 11, at flowers of *Melilotus officinalis* by Mrs. W. P. Cockerell.

SPINOLIELLA Ashmead

The species of this genus are rather numerous in the West but no locality seems to possess any large number. The greatest concentration or diversification of specific forms seems to be in California, whence nine have been recorded. The American Museum expeditions obtained only three in Colorado. Possibly no others occur in the regions covered, though *S. helianthi* Swenk and Cockerell, collected by Cary in Sioux County, Nebraska, might be expected in eastern Colorado and Wyoming. It has deep yellow bands on the abdomen. *S. meliloti* Cockerell is a very distinct species from southern New Mexico.

Spinoliella zebrata (Cresson)

COLORADO: 48 ♂, 4 ♀, Ridgeway, about 7000 ft. alt., among *Artemisia*, cactus, etc., July 10, 1919, collected by Messrs. Lutz and Bailey.

The large size readily distinguishes this species from the other two. The male has the face below the antennæ entirely yellow and the scape yellow in front. The female varies somewhat. In one specimen the light spots below the antennæ are lacking and the clypeus is black except the sides broadly and a median band not reaching the upper and lower margins. The male may either have or lack yellow marks on the upper margin of the prothorax.

Spinoliella australior (Cockerell)

COLORADO: 10 ♀, La Junta, about 4100 ft. alt., August 12, 1920; 1 ♀, Pueblo, vacant lots in town, August 9, 1920; 1 ♂, Boulder, about 5300 ft. alt., on plains, August 8, 1919.

The male is distinguished from the light-faced form of *scitula* by the presence of the dog-ear marks. In Sioux County, Nebraska, Swenk found *S. australior* common, but no *scitula* were obtained. *S. scitula* is the characteristic form of the mountain region of Colorado. At Fort Collins, however, Baker found both *scitula* and *australior*.

Spinoliella scitula (Cresson)

WYOMING: 11 ♂, 34 ♀, Green River, about 6100 ft. alt., June 29 and July 2, 1920; 1 ♀, Rock Springs, about 6250 ft. alt., June 29, 1920; 1 ♂, 1 ♀, Jackson, about 6300 ft. alt., July 13-17, 1920. COLORADO: 1 ♂, 2 ♀, Leadville, about 10,300 ft. alt., August 3-5, 1919; 7 ♂, 25 ♀, Glenwood Springs, about 5800 ft. alt., July 22-29, 1919, and August 5, 1920, various collectors; 3 ♀, Alamosa, about 7500 ft. alt., at *Radicula sinuata* along the Rio Grande, June 15, 1919; 1 ♀, Monte Vista, about 7650 ft. alt., June 16, 1919; 13 ♂, 15 ♀, Rifle, about 5400 ft. alt., on a bare sandy place used as a play-ground, July 19-21, 1919; 1 ♀, north of Animas near Durango, about 6600 ft. alt., at alfalfa, June 26, 1919; 1 ♀, Aspen, about 7900 ft. alt., July 25, 1919.

There is a variation of the female in which the fifth abdominal segment has only very minute, hardly noticeable spots. This must not be confused with *australior*, as the clypeus entirely lacks the light median band of that species and the face-marks in general agree with *scitula*. Five of the six Glenwood Springs females, two from Rifle, and the one from Jackson belong to this variant form.

The males also vary. Those from Glenwood Springs and Leadville have the clypeus largely black; Rifle males vary from much black on the clypeus to hardly any; Green River and Jackson males have the clypeus white, slightly marked with black or with only two dots or small spots. The form with white clypeus is typical *scitula*, the male described by Cresson as *pictipes*.

For the nesting habits, see Bull. Amer. Mus. Nat. Hist., XXII, p. 440.

HOPLITINA Cockerell

This genus was first called *Hoplitella* (1910) but, that name being preoccupied, was altered to *Hoplitina* (1913). The type is *H. pentamera* Cockerell from Claremont, California. In 1916 Crawford added a second species, *H. hesperia*, also from California. When I described *H. pentamera* I also published *Osmia remotula*, based on a female from Claremont, California. The mouth-parts were retracted and were not

examined, but the venation and other characters were so exactly like those of the Old World group *Erythrosmia*¹ that I had no hesitation in referring it there. Now comes a female from the Grand Canyon, Arizona; it is very close to *O. remotula*, certainly congeneric with it, but clearly distinct. The mouth-parts are exposed and the maxillary palpi have five subequal joints, the last two long and very slender. *Osmia* (*Erythrosmia*) *andrenoides* Spinola, which is to be considered the type of *Erythrosmia*, differs from true *Osmia* in having four-jointed maxillary palpi,² which are stout and very bristly, the two middle joints long, cylindrical, and about equal, the last pyriform and about half as long as the penultimate. *Erythrosmia* Schmiedeknecht may be considered a distinct genus, with the species *E. andrenoides* (Spinola) and *E. melanura* (Morawitz). *Osmia fallax*, which I have from Malaga, April, (Morice), appears to be closely related but is placed in a different group on account of the long axillar spines. *Osmia semirubra* Friese, which I have from Jericho, (Morice), probably falls in *Erythrosmia*.

If we thus exclude the American forms from *Erythrosmia* and transfer them to *Hoplitina*, the separation of the latter from *Osmia* becomes difficult. They are, however, remote from typical *Osmia* and it is merely a question of recognizing either a genus or a subgenus. The species assigned to *Hoplitina* in the broader sense may be separated as follows.

1. First three segments of abdomen wholly without hair-bands, even at the sides; tegulae black, faintly reddish posteriorly; first recurrent nervure joining second submarginal cell about twice as far from base as second from apex.
remotula (Cockerell).
First three segments of abdomen with conspicuous white hair-bands, at least at sides.....2.
2. Tegulae black; first recurrent nervure joining second submarginal cell far from base, the second about half as far from apex.....*incanescens*, new species.
Tegulae red or reddish.....3.
3. First recurrent nervure joining second submarginal cell very near base, the second more remote from apex; basal nervure exactly meeting nervulus (falling some distance short of it in *E. andrenoides*)...*pentamera* (Cockerell).
Recurrent nervures equally distant from base and apex of second submarginal cell; proportions of palpal joints also differing.....*hesperia* Crawford.

In the U. S. National Museum Crawford has rearranged the bees of this group and has separated *hesperia* as the type of a new genus, as yet

¹Ashmead regarded *Erythrosmia* as a synonym of *Pseudosmia* Radoszkowsky. *Pseudosmia* was based on a mixture of species, including only one *Erythrosmia*, *andrenoides*. I will designate as the type the first species, *P. cristata* (Fonscolombe). I have this from Marseilles, (Morice), and it is very different from *Erythrosmia*. *Pseudosmia*, on this basis, is apparently not separable from *Anthocopa* Lepeletier, the type of which is *papaveris* (Latreille). *Furcosmia* Schmiedeknecht, 1886 (*papaveris* here designated the type), is the same group.

²Concerning the palpi of *Osmia*, see Titus, 1901, Canadian Entomologist, p. 257.

unpublished. Possibly this genus should include all of the above species except *pentamera*.

***Hoplitina incanescens*, new species**

♀.—Length about 8 mm.; robust. Black, with the first three abdominal segments clear red, the extreme base of the fourth also red; eyes pea-green. Pubescence abundant, white; first three abdominal segments with white marginal hair-bands at sides; apical segments appearing gray from a covering of appressed hairs. Flagellum very obscurely reddish beneath. Tegulae shining black. Wings hyaline, very faintly dusky; nervures and stigma black; basal nervure falling just short of nervulus, which is arched outward. Mandibles very broad at apex, acutely tridentate; tongue long; second and fifth joints of maxillary palpi each about $95\ \mu$ long, the third and fourth each about 88. Ventral scopa white, very short, carrying very pale yellow pollen.

In general like *H. remotula* but considerably larger, with a polished spot in the median line behind the ocelli, disc of mesothorax rather sparsely and weakly punctured (densely and minutely in *remotula*), abdomen with lateral bands, spurs fuscous. The metathorax is as in *remotula*.

ARIZONA: 1 ♀, Grand Canyon, about 7000 ft. alt., May 24, 1918, collected by Frank M. Jones.

***CHELYNIA* Provancher**

When reporting on this genus in Amer. Mus. Novitates No. 21, the following species was overlooked, being mixed with *Osmia*, which it so much resembles.

***Chelynia pavonina* Cockerell**

WYOMING: 1 ♂, Jackson, about 6600 ft. alt., July 14, 1920. COLORADO: 1 ♀, Pagosa Springs, about 7700 ft. alt., June 22, 1919.

The male has pale hair on the mesothorax, but in the female it is all black. The female is brilliant peacock-green, with the pleura bluer and the mesothorax yellowish green. The male has the abdomen much more purple than in the type, the colors being exceedingly rich.

56.9,61 E (119:7)

SPECIES OF AMERICAN PLEISTOCENE MAMMOTHS

ELEPHAS JEFFERSONII, NEW SPECIES

BY HENRY FAIRFIELD OSBORN

It appears probable that all the elephants which arrived in America belong in the division of the MAMMOTHS, subfamily Mammontinae. Six species of these large and interesting migrants have been successively proposed as follows:

Elephas jacksoni Mather, 1838. Type figured and described. Indeterminate until the type can be located.

Elephas americanus De Kay, 1842. Type figured and described; since destroyed by fire. Undoubtedly a synonym of *Elephas primigenius*.

Elephas columbi Falconer, 1857. Type in the British Museum 40769; cast in the American Museum 1747. Closely related to *Elephas imperator* Leidy.

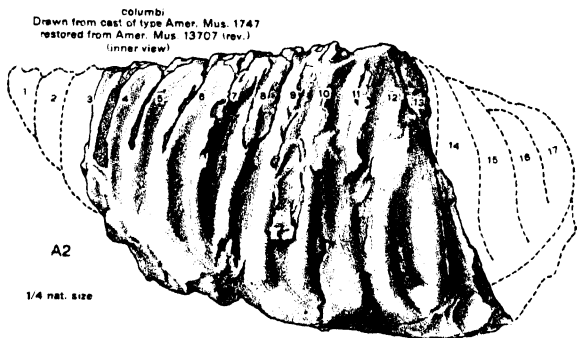


Fig. 1. Type molar of *Elephas columbi*, right M₃, drawn from the inner side. One-fourth natural size.

Elephas imperator Leidy, 1858. Type in National Museum 185; cast in American Museum 2568.

Elephas texianus Owen, 1859. *Nomen nudum*; name only without definition or designation of type.

Elephas hayi Barbour, 1915. Excellent figure and description. Nebraska Museum. Regarded as a primitive form related to *Elephas imperator*.

The present article relates explicitly to the type characters of *Elephas columbi*, of *E. imperator*, and of the American specimens referred to *E. primigenius*, three species which have become more or less confused in all the previous literature because the characters of the type specimens

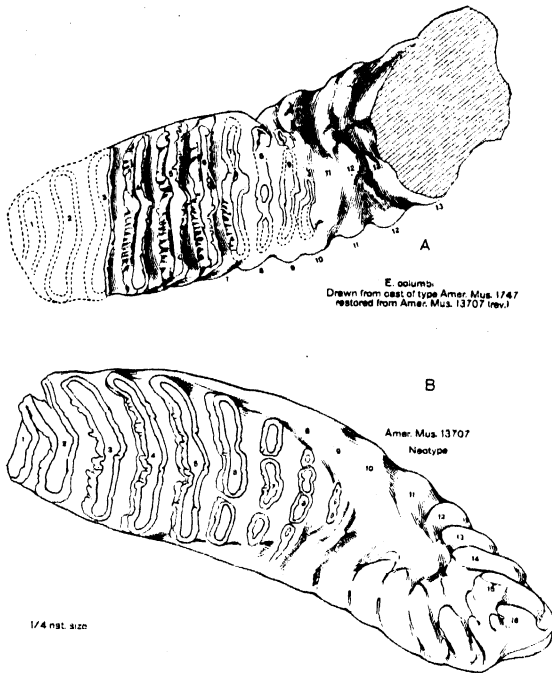


Fig. 2. A, Type molar of *Elephas columbi*, crown view. B, Neotype molar, M₃, of the left side, crown view. One-fourth natural size.

have not been precisely determined and compared. The object of the present communication is to clear up this confusion and to propose ***Elephas jeffersonii*** as a new species of American Pleistocene mammoth.

TYPE CHARACTERS OF *Elephas columbi*

The type characters of this species are clearly shown in the accompanying figures. The type is a third lower molar of the right side, with portions of eleven ridge-plates out of an original total of sixteen or seventeen; this is shown by comparison with the neotype (Amer. Mus. 13707), which consists of non-associated upper and lower molars found in the phosphate beds near Charleston, S. C. In these specimens the ridge formula is: $M\ 3\ \frac{17-18}{16-17}$, as shown in Figs. 1-3. The ridge-plates do not exceed six in 100 mm. In the unworn condition (Fig. 3), in which only eight ridge-plates have come into use, the third superior and inferior molars are relatively short anteroposteriorly and deep vertically, because they contain so few ridge-plates.

We thus find by the characters of the type and neotype specimens that the real *Elephas columbi* is not the animal we have been describing under this name; it is a dwarf form, perhaps a dwarf female, of the animal which we have been describing under the name *Elephas imperator*.

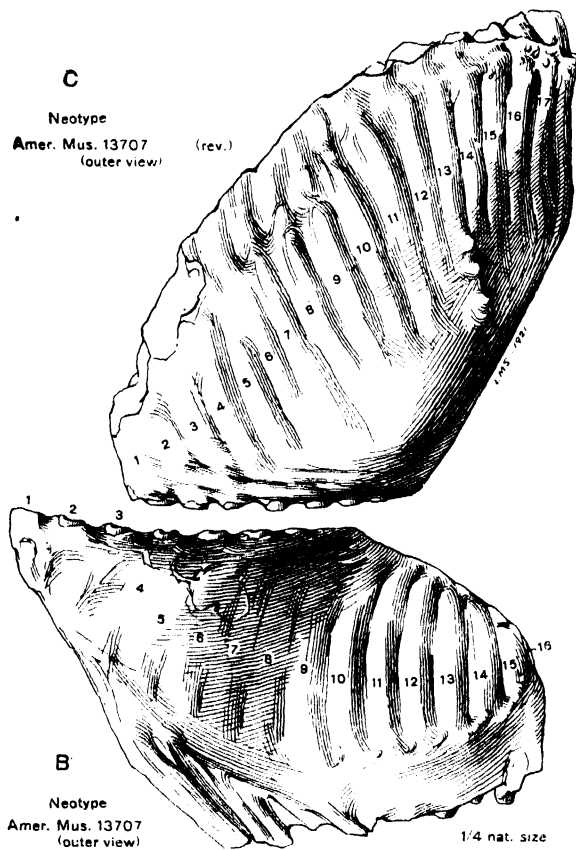


Fig. 3. Neotype molars of *Elephas columbi*. C, External view of M₂. B, External view of M₃; same tooth as Fig. 2, B. One-fourth natural size.

CHARACTERS OF THE *Elephas imperator* TYPE

We are indebted to the National Museum for the loan of the *Elephas imperator* type specimen (Fig. 4), enabling us to determine exactly to what portion of the complete neotype tooth (Fig. 5) this ancient and much battered type belonged; the eight ridge-plates of the type which are preserved, in comparison with those of the neotype (Amer. Mus.

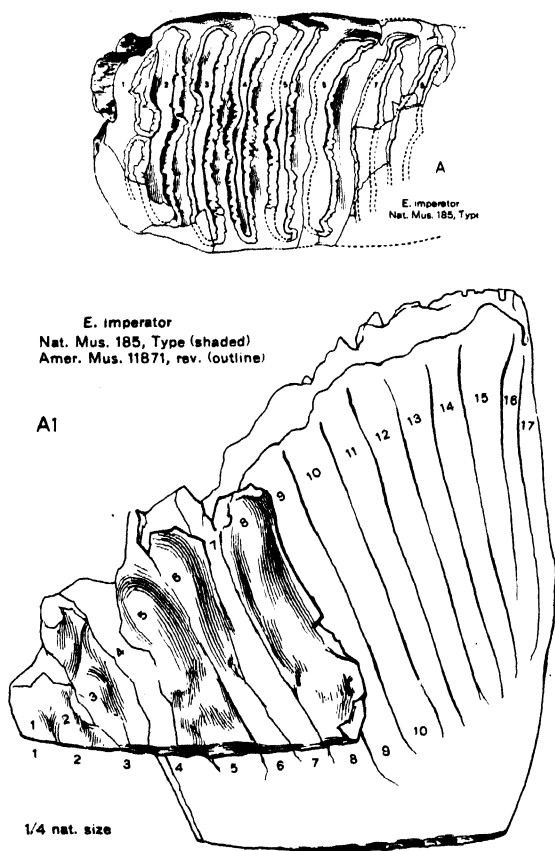


Fig. 4. A, Type molar, right M^3 , of *Elephas imperator* crown view. A 1, Type molar (shaded) placed in position with less worn (unshaded) neotype molar, both belonging to M^3 of the right side.

11871), constitute the anteroposterior portion of a much-worn molar, M^3 of the right side, in which thirteen ridge-plates were in use out of an estimated total of seventeen. Of these plates five occupy a line 100 mm. long; this is because the ridge-plates are arcuate and widest apart in the middle portion of the crown. The neotype tooth (Amer. Mus. 11871), from Guadalajara, Jalisco, Mexico, appears to attain the full size of the superior grinders of this species of mammoth; the ridge formula may be written $M^3 \frac{17-18}{18-19}$. This accords with the actual average count of the ridge-plates in *E. imperator* by Hay (1914) and by Osborn (1921-1922) in individuals which can without question be referred to *E. imperator*. Doubtless specimens may be found with the ridge-plate formula

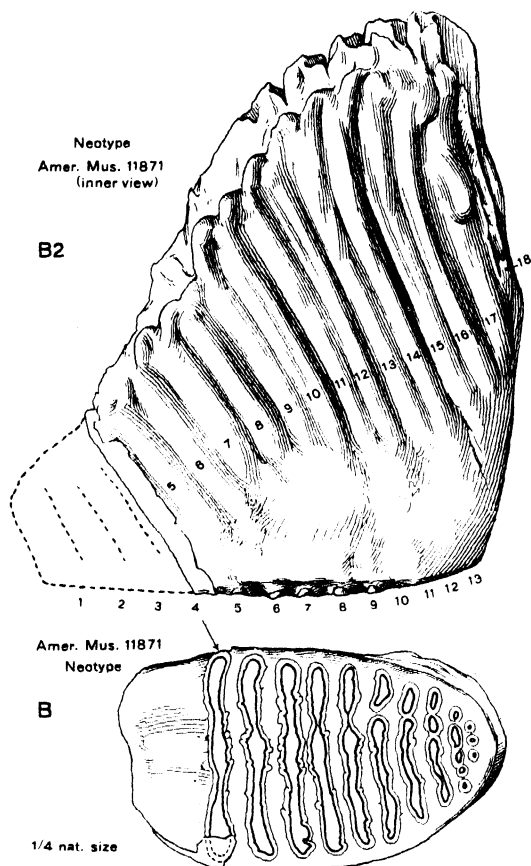


Fig. 5. B 2, Neotype molar of *Elephas imperator*, M^3 of the right side, inner view. B, The same, crown view. One-fourth natural size.

$M^3 \frac{2}{1} p$. In the neotype (Fig. 5) thirteen plates were in use; in the referred skull (Amer. Mus. 14476) fifteen plates were in use (Fig. 6B); in the referred lower jaw (Amer. Mus. 14558) fifteen plates were in use (Fig. 6A). The total ridge-plates in M^3 attain nineteen, as clearly shown in Fig. 6A; thus we have the following ridge formulæ:

Ancestral *Elephas meridionalis* of western Europe $M^3 \frac{13-14}{11-14}$; *Elephas columbi* of southern United States $M^3 \frac{17-18}{16-17}$; typical *Elephas imperator* $M^3 \frac{17-18}{18-19}$.

The cranial characters observed in three more or less complete skulls referred to *Elephas imperator* tend to support the direct descent of this animal from the *E. meridionalis* of the Val d'Arno, Upper Pliocene of Italy.

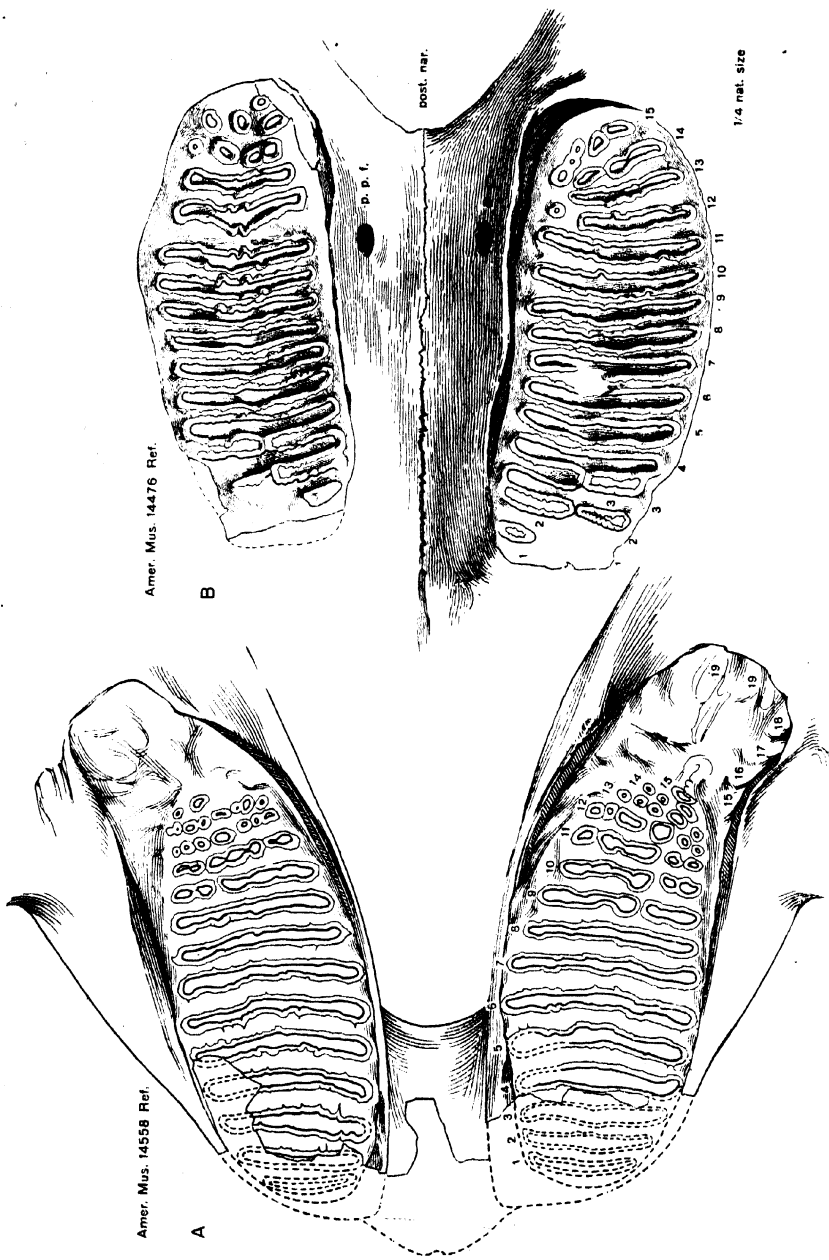


Fig. 6. Superior and inferior molars of *Elephas imperator*, referred American Museum specimens. A. Inferior molars with fifteen ridge-plates in use. B. Superior molars with fifteen ridge-plates in use. These two individuals are believed to be of corresponding age. They exhibit mechanical reversal of the convex and concave surfaces both in the crown contours, crown surfaces, and ridge-plates. One-fourth natural size.

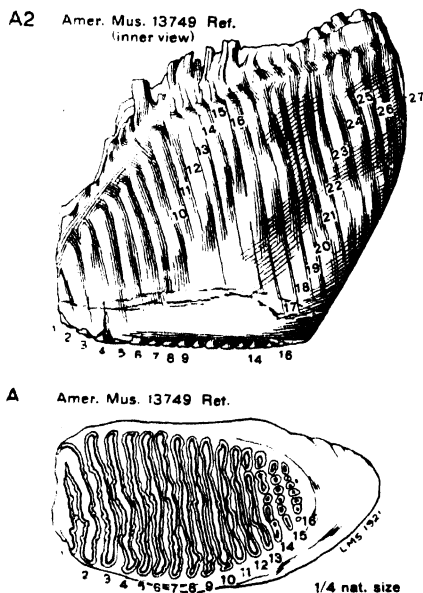


Fig. 7. Right third superior molar, M³, of *Elephas primigenius*, Alaska, showing the maximum compression of the ridge-plates. One-fourth natural size.

CHARACTERS OF AMERICAN SPECIMENS REFERRED TO *Elephas primigenius*

Elephas primigenius, which ranged through the entire Pleistocene epoch, from the Lower Pleistocene forest-bed deposits of East Britain to the southerly range of this animal in the middle United States, is a collective species embracing an undoubted progressive evolution and intensification of its specific characters extending over a very long period of time. It exhibits various extremes of fore-and-aft compression of the cranium, with related fore-and-aft compression of the grinding teeth. The cranium is high, pointed at the summit, relatively narrow, and relatively deep. The forehead from the peak of the cranium to the extremity of the nasals is relatively elongate and slightly concave. Including within the definition all the specimens observed by Hay (1914) and by Osborn (1921-1922) which may certainly be included within this collective species, the collective ridge formula of the last two molar teeth is: M 2 $\frac{1.8-1.9}{1.9}$, M 3 $\frac{2.3-2.8}{2.3-2.4}$.

COMPRESSION.—As compared with *E. columbi* and *E. imperator*, 10 ridge-plates are compressed into a line 100 mm. in length; the most highly compressed tooth observed by Osborn is an M³ from Alaska (Amer. Mus. 13749) in which 13 ridge-plates are compressed into a line 100 mm.

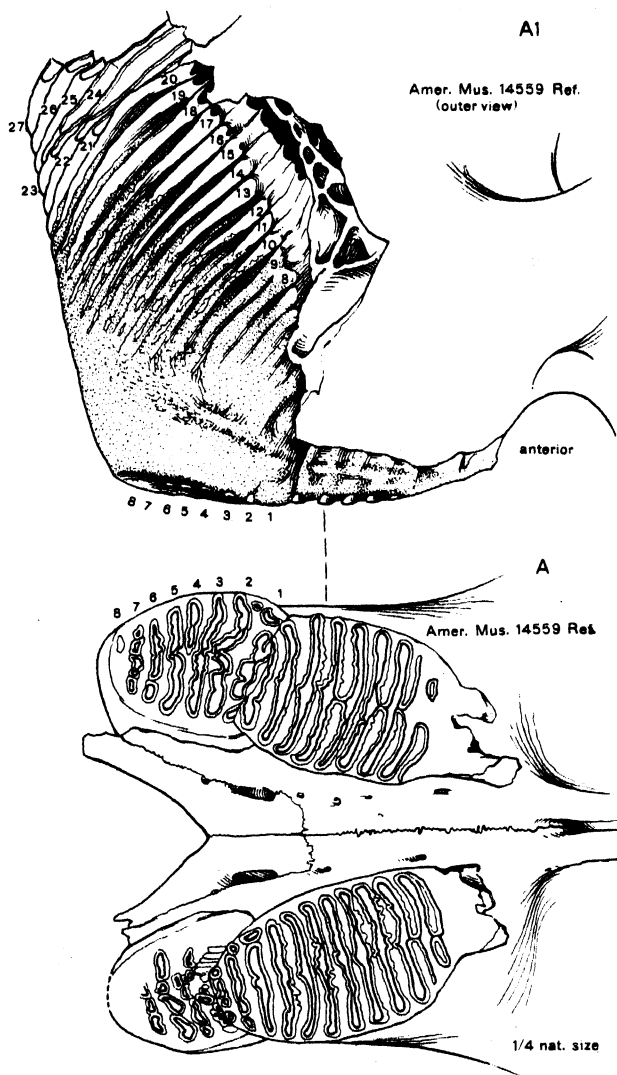


Fig. 8. Fourth and third superior molars of the right side of *Elephas primigenius*, Indiana. A 1, External view showing twenty-seven ridge-plates of M⁴. A, Crown view showing M³ with eight ridge-plates in use, closely compressed to M² with nine ridge-plates in use. One-fourth natural size.

in length (Fig. 7); a similar condition prevails in a female skull from Indiana (Amer. Mus. 14559) in which 13 ridge-plates are compressed into a 100 mm. space, the total number of ridge-plates rising to 27 (Fig. 8). The prevailing condition, however, is of the kind shown in Fig. 9, namely, Amer. Mus. 13752, from Alaska, in which the ridge formula is $M\ 3\ \frac{2}{3}$, here figured with a lower molar (Amer. Mus. 14371) in which the ridge formula is $M\ 3\ \frac{2}{4}$; in these specimens there are 10 plates in a 100 mm. line; these less compressed molars are arcuate, thus the count of the ridge-plates is greater on the concave side of the tooth and smaller on the convex side.

For example, an M^3 (Amer. Mus. 10656) from Germany is as follows:

- 10 ridge-plates in 100 mm. on the outer convex surface,
- 11 ridge-plates on the horizontal coronal surface,
- 12 ridge-plates on the inner concave surface.

In the highly compressed upper tooth (Amer. Mus. 13749), M^3 , from Alaska, the count on all three measurements is the same, namely:

- 13 ridge-plates in 100 mm. on the outer convex surface,
- 13 ridge-plates in 100 mm. on the horizontal coronal surface,
- 13 ridge-plates in 100 mm. on the inner concave surface.

These M^3 conditions are reversed in counting the ridge-plates in the lower molars, M_3 , in which the outer surface is concave and the inner surface is convex. For example, in an M_3 from Alaska (Amer. Mus. 14343) the count is as follows:

- 10 ridge-plates in 100 mm. on the outer concave surface,
- 10 ridge-plates in 100 mm. on the horizontal coronal surface,
- 8-9 ridge-plates in 100 mm. on the inner convex surface.

It follows from the above observations that the horizontal coronal section gives, as a rule, an average between the inner and outer sides; the average in *E. primigenius* is 10 ridge-plates in 100 mm., the minimum observed is 8 in 100 mm., the maximum observed is 13 in 100 mm. This range of compression applies to fifteen specimens ranging through England, Germany, Siberia, Alaska, Ohio, and Indiana.

The worn coronal surface is sometimes fully horizontal, i. e., at right angles to the perpendicular ridge-plates; in such case it registers the exact distance between the plates. In other cases the wear is obliquely horizontal; in which case it increases the actual distance between the plates. It is important to note also that the ridge-plates are arcuate and more closely compressed towards their summits; thus more ridge-plates may be counted in 100 mm. at the summit of the crown than

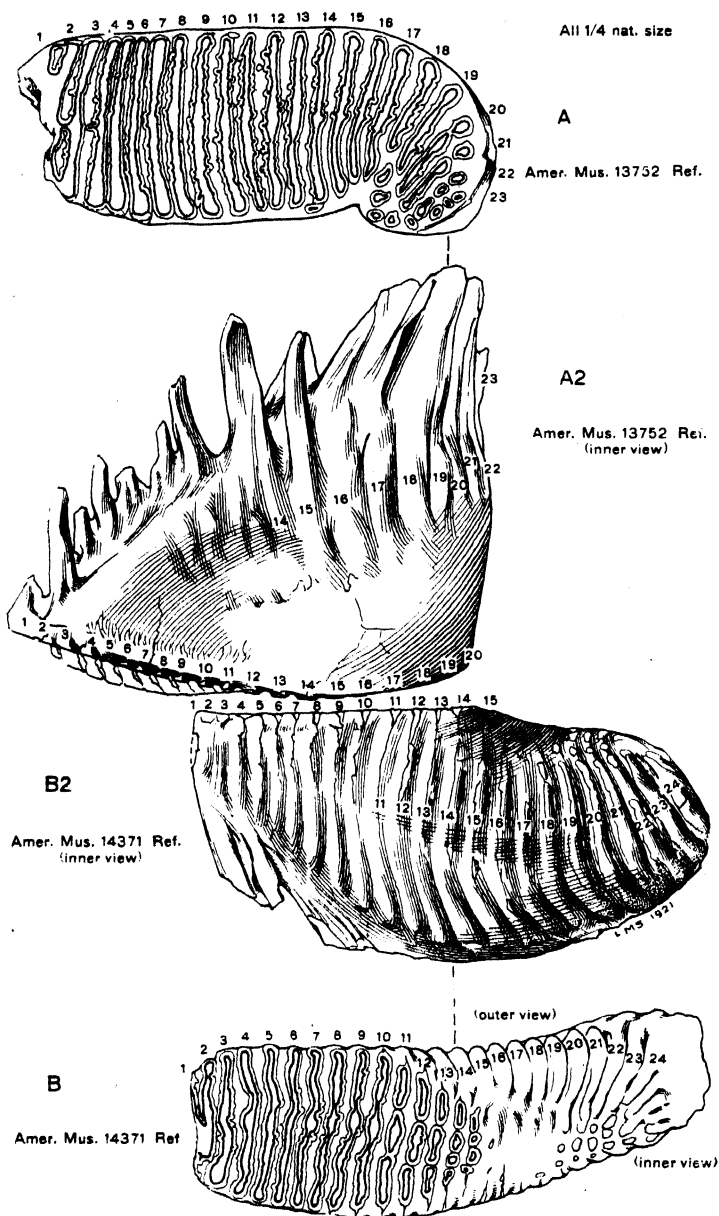


Fig. 9. Posterior superior and inferior molars of *Elephas primigenius*, Alaska, of less compressed type than the molars shown in Figs. 7 and 8. A, Crown view, twenty-three ridge-plates. A 2, Inner view of same. B 2, Inner view of M₃ of another individual. B, Crown view of same.

at the base of the crown, and as a rule the ridge-plate count should be taken midway between the summit and the base, both on the inner and outer sides.

***Elephas jeffersonii*, new species**

The above diagnoses of the real specific characters of the grinding teeth of *Elephas columbi* (closely related to if not identical with *E. imperator*) and of the true *E. primigenius* leaves without a name the animal which previously has been described in all the literature (excepting Soergel's recent Memoir) as *Elephas "columbi."*

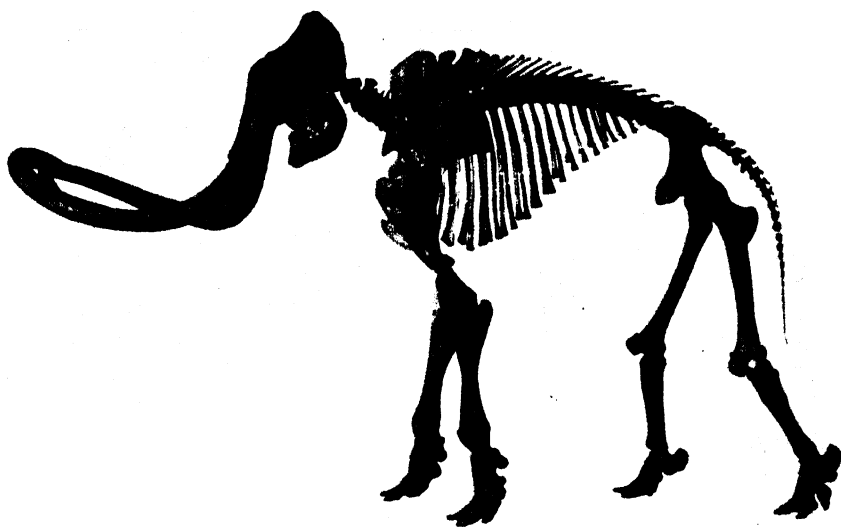


Fig. 10. Type skeleton of *Elephas jeffersonii* (Amer.Mus. 9950) as mounted in the American Museum. Reduced to one-fifty-second natural size.

This animal is better known than either of the others; it is represented in all the collections of the principal museums of the United States, as described by Hay (1914), and particularly in the American Museum by four especially fine specimens. Of these we select as the type Amer. Mus. 9950, including the skull, jaws, and greater part of the skeleton (Fig. 10), found near Jonesboro, Indiana, on the farm of Dora S. Gift; purchased for the Museum with the Jesup Fund in 1904, restored and mounted in 1906; described by Osborn in 1907 as *Elephas columbi*, determined by Hay (1914) as *Elephas primigenius*.

As the paratype of this species we select a pair of upper and lower grinding teeth of both sides (Amer. Mus. 10457) acquired with the Warren Collection in 1906 and described by Warren in 1855 (p. 163, Pl. xxviii, fig. C) as *Elephas "primigenius."*

This typical American species is named in honor of the third president of the United States, Thomas Jefferson, in commemoration of his long-continued devotion to mammalian palaeontology.

The paratype (Amer. Mus. 10457) best affords comparison with the species diagnosed above; the ridge formula is $M\ 3\ \frac{30}{24\frac{1}{2}-26}$ the right lower M_3 , (Fig. 11 B2) presenting the last lower ridge-plates more fully developed than in the left lower molar (Fig. 11 B1). It is interesting to observe (Fig. 12 A, B), that these same paratype molars show eighteen ridge-plates in use in both M^3 and M_3 , but that the superior molars show four to five ridge-plates in excess of the inferior molars, the formula being $M\ 3\ \frac{30}{24\frac{3}{4}-26}$. The compression of the ridge-plates is directly intermediate between that of *E. columbi-E. imperator* and that of *E. primigenius*, namely, 7 ridge-plates in 100 mm.; in order to compare this compression with the ridge-plate measurement given by Hay (1914) in his description of "*Elephas columbi*," the inner, outer, and horizontal measurement is as follows:

	PARATYPE	TYPE
M^3 outer convex surface, 7-8 ridge-plates in 100 mm.		
oblique mid-coronal surface, 8-8½ ridge-plates in 100 mm.		
inner concave surface, 9-10 ridge-plates in 100 mm.		
M_3 outer concave surface, 6½-7 ridge-plates in 100 mm.		8 ridge-plates in 100 mm.
oblique mid-coronal surface, 7-7½ ridge-plates in 100 mm.		7-7½ ridge-plates in 100 mm.
inner convex surface, 6-6½ ridge-plates in 100 mm.		7 ridge-plates in 100 mm.

This compression, with an average of 7-8 ridge-plates in 100 mm., concurs with the measurements given by Hay in nine of the specimens in the National Museum, namely, 7-8 ridge-plates in 100 mm.¹ Comparing the type ridge-plate formula of *E. jeffersonii*, $M\ 3\ \frac{30}{24\frac{3}{4}-26}$, with that of *E. primigenius*, $M\ 3\ \frac{23-28}{23-24}$, we observe that the number of ridge-plates is similar but the lesser compression of ridge-plates in *E. jeffersonii*, namely, 7:100, as compared with *E. primigenius*, 10:100, is correlated with the relatively long, gently arcuate grinders of *E. jeffersonii* as compared with the short, deep, strongly concavoconvex grinders of *E. primigenius*. The paratype molars of *E. jeffersonii* in which eighteen upper and lower plates simultaneously come into use compare closely in measurement and character with the type molars of *E. jeffersonii* in which only sixteen plates have come into use. In the lower molars of the type (Amer. Mus. 9950) the sixteen plates in use indicate that the animal was of about the same age as the paratype in which eighteen plates were in use:

- 7 ridge-plates in 100 mm. on the convex inner side,
- 7-7½ ridge-plates obliquely worn on mid-coronal surface,
- 8 ridge-plates in 100 mm. on the concave outer side.

¹Dr. O. P. Hay writes March 14, 1922: "In counting the ridge-plates I try to count the ridges on the side of the tooth, about half way down and at right angles with the plates." He does not state whether his count is uniformly made on the inner or on the outer side of the tooth, which makes a difference of from one to three plates in the count, as shown above.

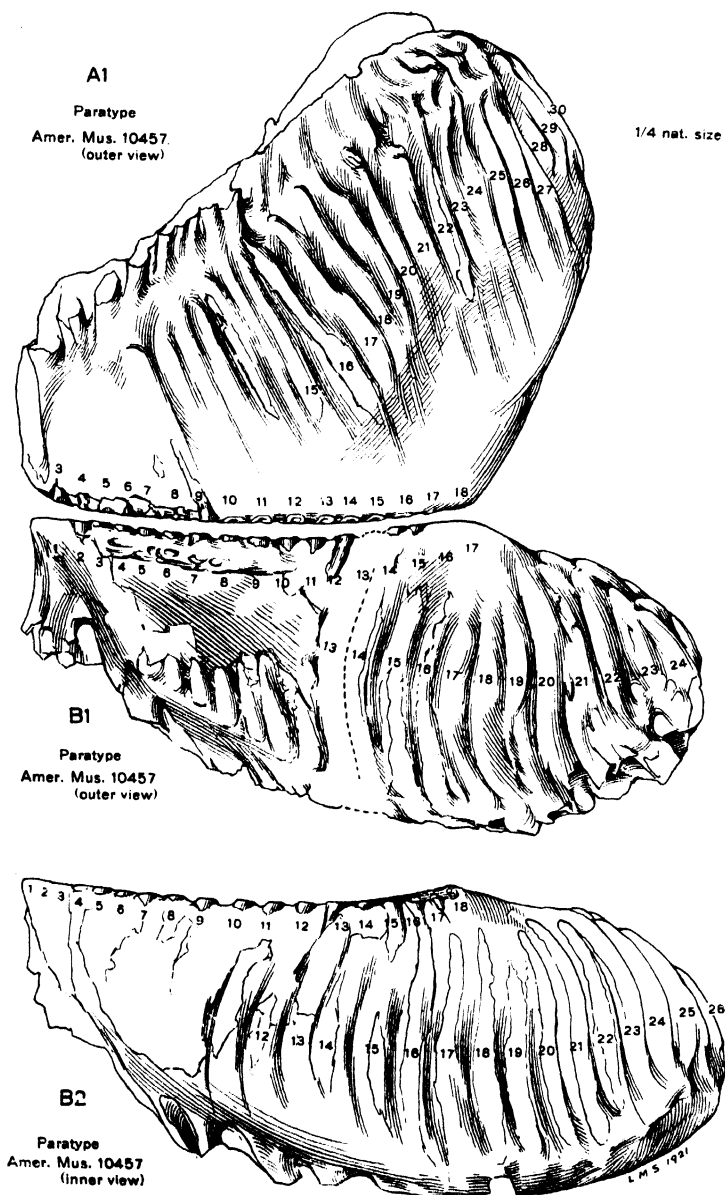


Fig. 11. Paratype molars of *Elephas jeffersonii*, M³, M₃, of the same individual, Amer. Mus. Warren Coll., Zanesville, Ohio.

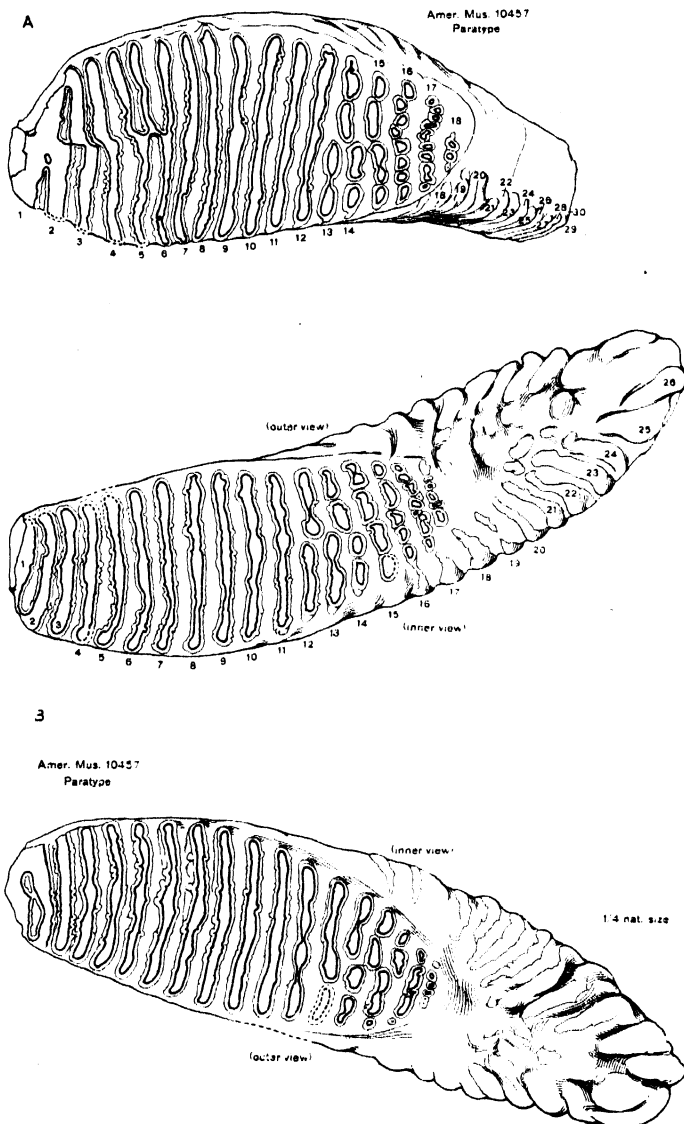


Fig. 12. Paratype molars of *Elephas jeffersonii*, the same specimens as in Fig. 11. A, Crown view of left superior molar, M². B, Crown views of right and left inferior molars. Both upper and lower molars with eighteen ridge-plates in use. One-fourth natural size.

CRANIAL CHARACTERS.—Still more obvious are the differences between the relatively long, broad, and shallow crania of *E. jeffersonii* and the relatively short, narrow, and deep crania of *E. primigenius*, proportions which are correlated respectively with the corresponding proportions just described and figured in the teeth.

The four complete skulls of this species known to the writer are those of (1) in the type mounted skeleton (Amer. Mus. 9950); (2) the fine male skull associated with the jaws and a large part of the skeleton (Amer. Mus. Cope Coll. 8681) from Whitman County, Washington, now labeled "*Elephas columbi*"; (3) the young male skull (Amer. Mus. Cope Coll. 14475) from Dallas, Texas, also labeled "*Elephas columbi*." (4) To these should be added the very large male skull (Nat. Mus. 10261) collected near Cincinnati, Ohio; in this specimen the ridge formula is M 3^{2.6}; seventeen plates were in use; the compression of the grinding teeth is greater, namely:

- 9 ridge-plates in 100 mm. on the outer side, at the worn edge,
- 9 ridge-plates in 100 mm. on the worn mid-coronal surface.

The cranial characters of this specimen are entirely similar to those of the three skulls in the American Museum collections, except that it is larger and more robust.

CONCLUSION

The American elephant heretofore widely known as "*Elephas columbi*," the Columbian Mammoth, will hereafter be known as *Elephas jeffersonii*, the Jeffersonian Mammoth. The question whether the animal heretofore known as *Elephas imperator*, the Imperial Mammoth, shall hereafter become known as the Columbian Mammoth under the law of priority, must remain open for the present. Certainly the real type of *Elephas columbi* represents an animal very close to the real type of *Elephas imperator*, but inasmuch as the type and neotype of *Elephas columbi* belong to dwarfed individuals, it is possible that when these animals become more fully known we shall find that *Elephas columbi* and *Elephas imperator* may be maintained distinct, as it is eminently desirable they should.

BIBLIOGRAPHIC NOTE.—The first revision of the Pleistocene mammoths and mastodons of America by Dr. O. P. Hay is to be found in 'The Pleistocene Mammals of Iowa,' Iowa Geological Survey, Vol. XXIII, Annual Report, 1912, by O. P. Hay, Research Associate of the Carnegie Institution of Washington, published in 1914. The second revision by the same author is entitled 'Descriptions of Some Pleistocene Vertebrates Found in the United States,' Proceedings of the United States National Museum, Vol. LVIII, No. 2328, by O. P. Hay, Associate of the Carnegie Institution of Washington, published in 1920. The section devoted to the Proboscidea in the 1914 Memoir, pp. 328-449, Pls. XLIII-XLIX, was prepared after the author had examined all the

chief collections in the United States including the Pleistocene collections in the American Museum.

The manuscript of the present article in the *American Museum Novitates* was sent to the American Museum Press in its present form on June 12, 1922.

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56. (117:51.7)

DISCOVERY OF CRETACEOUS AND OLDER TERTIARY STRATA IN MONGOLIA¹

BY WALTER GRANGER AND CHARLES P. BERKEY

The American Museum commenced its natural history explorations in Asia in 1916. The First and Second Asiatic Expeditions, in charge of Roy Chapman Andrews in 1916-1917 and 1918-1919, were engaged in zoölogical exploration and in laying the foundations for broader work. The Third Asiatic Expedition, sent out by The American Museum of Natural History, the American Asiatic Association, and Asia Magazine, has included zoölogy, palæontology, geology, and geography under the leadership of Mr. Andrews, with Walter Granger as palæontologist, Charles P. Berkey as geologist and Frederick K. Morris as topographer, and other cognate lines of research may be taken up when the results of reconnaissance warrant it.

The scientific results of these expeditions will be published in numbered sequence as indicated below. The following reports or contributions have already been published:

- (No. 1) 'New Chinese Fishes.' By John Treadwell Nichols. Proc. Biol. Soc. Washington, XXXI, pp. 15-20, May 16, 1918.
- (No. 2) 'Description of a New Species of Serow from Yün-nan Province, China.' By Roy Chapman Andrews. American Museum Novitates, No. 6, March 24, 1921.
- (No. 3) 'The Birds of The American Museum of Natural History's Asiatic Zoölogical Expedition of 1916-1917.' By Outram Bangs. Bull. Amer. Mus. Nat. Hist., XLIV, Art. 20, pp. 575-612, December 30, 1921.
- (No. 4) 'Description of a New Loach from North-eastern China.' By Henry W. Fowler, American Museum Novitates, No. 38, May 25, 1922.

RECONNAISSANCE EXPEDITION IN MONGOLIA

On April 21, 1922, the Third Asiatic Expedition left Kalgan, North China, for its announced reconnaissance trip into Mongolia. It is planned to devote the first three weeks of the season to observations along the regular caravan route between Kalgan and Urga, the capital of Mongolia, and the rest of the season to points scattered far to the west, perhaps even as far west as Ulyosutai and Kobdo and the eastward extension of the Altai mountains.

¹Contribution No. 5. Asiatic Expeditions of The American Museum of Natural History.

The chief effort of the present season is to be devoted to geology, palæontology, geography, and zoölogy, but other scientific interests will be cared for in subsequent seasons if the reconnaissance warrants such expansion. It is believed that fields inviting more extended and detailed work will be discovered and that the reconnaissance will furnish a basis for final plans and indicate the nature of the problems that promise best results.

At the close of the season President Henry Fairfield Osborn is expected to join the expedition staff at the headquarters in Peking and will take an important part in the conferences in which plans for the next three years will be formulated.

The scientific staff on the present reconnaissance includes Roy Chapman Andrews, zoölogist, Walter Granger, palæontologist, Charles P. Berkey, geologist, and Frederick K. Morris, physiographer.

It is hoped that there may be opportunity to send short notes of observations or discoveries of special interest directly from the field but, in any case, a summary of the season's results will be issued with little delay on the return of the Expedition.

CRETACEOUS STRATA IN EASTERN ASIA.—The Third Asiatic Expedition announces, under date of May 3, 1922, that strata of Cretaceous age, overlain by two distinct Tertiary formations, have been discovered in the Gobi region of southeastern Mongolia.

They were found on the outbound trip from Kalgan to Urga at a point about 260 miles northwest of Kalgan. Strata of Cretaceous age are wholly unknown in Eastern Asia, as far as the writers are aware, and because of the apparent importance of the find, it was decided to leave the geologists in camp at this place while the rest of the party moved on. Accordingly Messrs. Berkey, Granger, and Morris spent a week in additional inspection of the ground and furnish the notes for this memorandum.

The best exposures of the Cretaceous formation are in the vicinity of the small salt marsh Iren Dabasu, where a total thickness of about 150 feet of nearly horizontal strata is judged to be of this age. Tertiary beds not older than the Miocene lie on top of the Cretaceous strata and are best exposed about five miles south of Iren. Twenty miles farther south early Tertiary beds were found in essentially the same relation.

In each occurrence of the Tertiary beds only a single horizon has furnished determinative fossils, but in the Cretaceous formation below, there are at least two fossil bone-bearing horizons. Fortunately the faunal evidence is unmistakable. Otherwise the widely different age

relations of the strata would not be suspected, for the corresponding physical breaks are inconspicuous and the beds are almost perfectly conformable.

The structural basin in which these strata lie measures forty miles across from north to south and is floored with ancient slates and limestones of extremely complicated deformation structure. This is only one of six basins of similar form and relation between Kalgan and Iren but it is much the longest one and the only one in which, thus far, the presence of strata of Cretaceous age has been proven.

In the vicinity of the small salt lake Iren Dabasu, the Cretaceous beds lie immediately on the slate floor of the basin and between this base and the first determinable beds of later age, in this case late Tertiary, about 150 feet of strata are exposed. The bottom members are dominantly sands and sandstones, prevailing thin-bedded, some of which are strongly cross-bedded and well cemented. The middle members become finer grained, more mixed with clay and more variable in color. The upper beds are dominantly clays and sandy clays and very fine sands, varying in color from white to dark red and drab and yellowish green. No less than twenty distinct beds or layers can thus be distinguished, all of which are regarded as belonging to a single geologic formation.

Only the lower members of this formation have been found to be fossiliferous. The list includes:

- 1.—Predentate dinosaurs, probably of the bipedal type.
- 2.—Carnivorous dinosaurs of at least two genera, the smaller one being of the *Ornithomimus* type.
- 3.—Crocodiles.
- 4.—Turtles of the *Trionyx* type.
- 5.—A few pelecypod shells.

Obretcheff, the Russian geologist, who gives an account of a reconnaissance trip over this same route from Ude to Kalgan, describes sedimentary beds at many places, always referring to them as representatives of the Gobi formation. His only age determination, however, was made on the basis of a few fragments of *Rhinoceros*, found at the escarpment five miles south of Iren. These remains were judged by Eduard Suess, to whom they were referred, to indicate an age not earlier than the Miocene. The Tertiary age of the rest of the occurrences mentioned by him seems to have been taken for granted and apparently that is in general correct, but it is evident that the Gobi formation cannot properly

include strata of both Tertiary and Cretaceous ages. It is clear also that the term Gobi formation or Gobi series is properly applied to the Tertiary beds instead of to those of Cretaceous age. The finding of a Cretaceous formation below makes a new designation necessary. For this purpose nothing seems to be as appropriate as the name of this locality. We therefore propose the term IREN DABASU FORMATION for these beds.

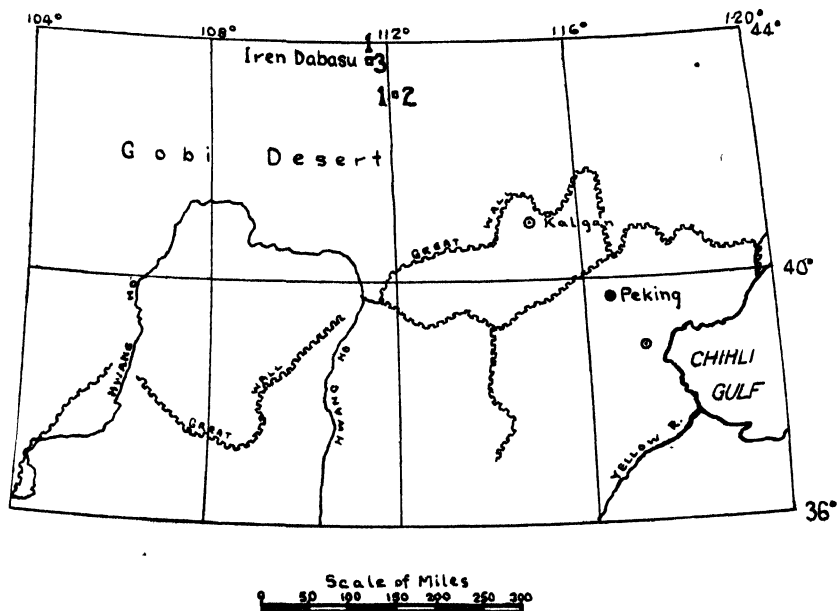


Fig 1. Sketch map showing location of type sections of Iren Dabasu Formation (Cretaceous) 1; Irdin Manha Formation (Eocene) 2; Houldjin Formation (Miocene) 3.

THE HOULDJIN BEDS (MIDDLE TERTIARY).—For the late Tertiary beds found five miles farther south and belonging to the Gobi Series of Obretcheff we propose the term **HOULDJIN BEDS**, taken from the local name of the upland formed by these beds. They are characterized by the following fossil content:

- 1.—A rhinocerid.
- 2.—A large carnivore.
- 3.—An artiodactyl of the size of a Virginia deer.
- 4.—An enormous mammal, probably a perissodactyl and possibly related to or identical with *Baluchitherium*, discovered by Forster Cooper in Baluchistan.
- 5.—A tortoise of large size.

There is a sharp physical change immediately below this formation and only the coarse sandy conglomeratic member at the very base has been found to be fossiliferous. The fossil remains are unusually fragmentary.

IRDIN MANHA FORMATION (EARLY TERTIARY).—For the early Tertiary beds found twenty-five miles farther south, also assumed properly to belong to Obretcheff's Gobi Series, we propose to use the term **IRDIN MANHA FORMATION**. It appears to lie immediately on Cretaceous beds, the Iren Dabasu formation, and again there is a sharp change in type of rock. The beds are cross-bedded sandstones, limy sands and pebbly sandstones. Only the lower member has been found to be fossil-bearing. It is characterized by the following forms:

- 1.—Small Lophiodonta of at least two species in great abundance.
- 2.—A perissodactyl about the size of the Upper Eocene titanotheres and possibly related to this family.
- 3.—A small artiodactyl.
- 4.—A small creodont.
- 5.—An abundance of turtles of both the hard-shelled and soft-shelled groups.
- 6.—Teleost fishes.

The geologic column for the Iren Dabasu basin therefore is essentially as in the following table.

Recent	Uplift and Erosion				
	Peneplanation				
Tertiary	Miocene or Upper barren sands	25' +	The Houldjin	The Gobi Series	
	Later Rhinoceros gravels	5'	Formation		
	Oligocene or Upper barren sandstones	25' +	The Irдин Manha		
	Eocene The Lophiodont bed	4'	Formation		
	Physical and Faunal Break				
Cretaceous	Upper barren members, chiefly clays, marls and fine sands	90'	The Iren Dabasu		
	Lower or Dinosaur beds, chiefly sands and sandstones	60'	Formation		
	Great unconformity				
Pre-Cretaceous	The old-rock floor, chiefly slates, limestones and igneous rocks				Probably The Nank'-on Series

VERTEBRATE FOSSILS, ADDITIONAL DETAILS.¹—Remains in all three beds are fragmentary, decidedly so in the Houldjin grave's, but they are of unusual interest apparently and we have taken everything which has any character. Dinosaurs are represented by one complete tibia, ends of femora and humeri, presacral and caudal centra, many good foot bones, including claws of fore and hind feet, portions of a small carnivorous dinosaur skull with two or three teeth, and two teeth of a predentate, as well as two portions of jaw with the alveoli of some teeth, also predentate. Remains of the small *Ornithomimus*-like creature are particularly abundant and the last day at Iren Dabasu we picked up probably fifty good foot bones and centra from two or three knolls. We could find no teeth of the little fellow though—wonder if he was edentate like *Struthiomimus*? The Cretaceous exposures are very limited so far as we could see but may, of course, outcrop in other basins to the east or west of the road. We did not have time to extend our work in either direction. The outcrops we did see will stand a more careful going over.

The Houldjin gravels are exposed as a rather thin capping to a low bench of Cretaceous which we followed for several miles. Things are badly broken up here—even such massive bones as the heads of femora and humeri were usually cracked into several pieces before deposition. There is one fine bone—a calcaneum of the big beast which would be a match for the astragalus of *Baluchitherium*² (?). I can think of nothing else to which it might belong. It is as long as the great *Megatherium* calcaneum from Long Branch, N. J., but is not edentate. A head of a femur is the size of one's head and other limb bone ends correspond. Some enormous rhinoceros teeth (broken) may belong with this animal. Smaller teeth are surely *Rhinoceros*. We did not explore the full length of the exposure and there are possibilities in excavation at one or two points of the bluff where we did explore.

The Irdin Manha beds offer the greatest opportunity for future work. Mammalian remains are abundant though fragmentary and we examined less than two miles of a line of exposures extending many miles both east and west of the trail. A small lophiodont (*Helalates*-like) is most abundant and we got numerous teeth besides two maxillæ (one with premaxilla and orbital region) and a few lower jaws, also numerous foot bones, limb bones and vertebræ. Next in abundance is a perissodactyl, looking much like our late Eocene titanotheres. We have several premolars, many incomplete molars and one lower jaw with p_3 - m_3 in fair condition.

¹Communicated in a letter by Mr. Walter Granger, dated May 10, 1922.

²A gigantic perissodactyl described by C. Forster Cooper from Baluchistan.

Other forms are curiously rare, a creodont lower jaw and an artiodactyl astragalus or two being the only things noted. Trionychids are common and we saw a complete though badly broken carapace which we were hurrying to get to our car before a storm overtook us the last day we were there. We made three trips down from Iren Dabasu camp but could not do more as our food was getting short and we had to join the rest of the party here.

Much additional detail is in possession of the Expedition which will appear in due course, and it is expected also that further investigation of this area and related ones will be made at a later time.

THE THIRD ASIATIC EXPEDITION.

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59.88, 18

THE SPECIES AND GEOGRAPHIC RACES OF *STEGANURA*¹

BY JAMES P. CHAPIN

Despite the modern tendency toward subdivision, ornithologists have come to think of the paradise whydah as a single species. In some recent papers, it is true, a northeast African subspecies has been recognized, under the name *verreauxii*, and some authors, too, have followed Professor Oscar Neumann² in calling the Senegal bird *Steganura paradisæa aucupum*. Aside from the browner nape of *aucupum*, the characters of these subspecies have been regarded with some hesitation. A shorter wing was believed to distinguish *verreauxii* from the south African *paradisæa*.³

Examination of the series of *Steganura* in the museums of Washington, Philadelphia, Cambridge (Mass.), London, Tring, Tervueren, and Vienna, in addition to material in the American Museum, has confirmed my view as to the existence of two distinct species; and in Vienna I was surprised to find a very broad-tailed specimen of *S. aucupum*, collected by Mr. Rudolf Grauer at Uvira, on the north end of Lake Tanganyika. So *aucupum* is not confined to northwest Africa, but extends, I find, to Eritrea, Angola, and even Gazaland. Furthermore, its range is intercepted on the west by the great Cameroon-Congo forest, where no paradise whydah occurs; and in northeast, east, and southern Africa its representatives are subspecifically distinct from the typical Senegal bird. *S. paradisæa* is exclusively east and south African, and cannot be subdivided.

The five forms of the genus which I find recognizable are shown in Figure 1. While the ranges of the two species overlap extensively, every form has a definite geographic distribution, as follows:

Steganura aucupum aucupum—Senegal to Shari River region.

S. a. longicauda—Upper Uelle District.

S. a. nilotica—Kordofan and Blue Nile to Eritrea.

S. a. obtusa—Kenya Colony and Lake Kivu, south to Gazaland and west to Angola.

Steganura paradisæa—Eritrea and Abyssinia south through East Africa to Cape Colony, also to Damaraland and Angola on the west.

¹Scientific Results of the American Museum Congo Expedition. Ornithology, No. 7.

²1908, Bull. Brit. Orn. Cl., XXI, p. 43.

³Sclater and Praed., 1918, Ibis, pp. 459-460.



Fig. 1. The forms of *Steganura*. One-third natural size.

- A—*S. aucupum* aucupum, Diourbel Senegal, October 8, 1907 (type).
- B—*S. a. longicauda*, Farafra, Uellé district, November 9, 1911 (type).
- C—*S. a. nilotica*, near Abu Zor, Blue Nile, January 6, 1913 (type).
- D—*S. a. obtusa*, Fungo Andongo, Angola, July 1, 1903 (Ansorge coll.).
- E—*S. paradisaea*, Tertale, S. Abyssinia, June 8, 1912 (Mearns coll.).

The adult males differ most markedly in the form and dimensions of the long tail feathers, which are relatively constant in each subspecies when once they have reached their full growth. But *S. a. nilotica* and *S. paradisæa* are also distinguished by their yellower hind-necks; and *S. a. obtusa* has a decidedly longer wing than any other form.

My interest was first aroused in this question by the specimens of paradise whydah which Mr. Herbert Lang and I collected in the north-eastern corner of the Belgian Congo. They are clearly nearest the Senegal form, though coming from so nearly the center of Africa. They agree in the brownish color of the nape; but a far better character is the shape of the longest pair of rectrices, which do not taper towards the tip in *aucupum*, as in so many of the birds from eastern and southern Africa. Strangely enough this distinction was not even mentioned by Neumann.

I am by no means the first to make this fact known. One would think that Linnæus might have noticed it, for his description of *Emberiza paradisæa*, in 'Systema Naturæ,' 10th edition, 1758, p. 178, was based on figures of earlier authors which showed tails of both shapes. His description, in this edition, cannot be restricted to any one of the forms since recognized, and the habitat was stated simply as Africa. In the 12th edition, however, of 1766, p. 312, besides adding one more reference (from Brisson), Linnæus improved the description by stating that the longest tail feathers were acuminate and falcate, and that the bird lived in Angola. Thus it is clear that he meant particularly the species figured in color by Edwards in 'Nat. Hist. Birds,' part 2, 1747, p. 86, Pl. LXXXVI.

Taxonomic importance was first attributed to the form of the tail by Cassin, when he described *Vidua verreauxii* from Abyssinia¹ with a tapering tip to the tail, and attempted to fix the name *paradisæa* on west African birds with broad-tipped tails. His attention, no doubt, had been called to this by the observant collector, J. Verreaux; and the name *Vidua sphænura*, which Bonaparte proposed for the same Abyssinian form a few months later,² was stated to be a manuscript name of Verreaux's.

So Verreaux long preceded me in the opinion that the difference in the tails is of more than subspecific value, and his view was adopted by authors of some well-known works on African birds. Reichenbach accepted *paradisæa* and *sphenura*,³ referring to the first-named as coming

¹1850, Proc. Acad. Nat. Sci., Philadelphia, V, p. 56.

²1850, 'Consp. Gen. Avium,' I, p. 449.

³1862, 'Die Fortsetzung der Singvögel,' p. 63.

with certainty only from Angola. Finsch and Hartlaub¹ called them tentatively *paradisæa* and *verreauxi*. Of recent years it has become customary to treat these at most only as subspecies. Then in 1908 Neumann showed that the Senegal bird was still without a name, although it was the best-known variety in captivity. He named the northwestern bird *S. paradisæa aucupum* and retained the name *verreauxi* for northeastern birds; but the latter is really not separable, I find, from the form Edwards described from Angola, and on which *paradisæa* of Linnæus is based.

What I have to propose, therefore, is (1) the specific distinctness of *aucupum* and *paradisæa*; and (2) the recognition of three new subspecies of *aucupum*, from regions in which the species has hitherto been unrecorded, but where two of them sometimes live side by side with *paradisæa*.

More complete descriptions follow.

***Steganura aucupum aucupum* O. Neumann**

Steganura paradisæa aucupum O. NEUMANN, 1908, Bull. Brit. Orn. Cl., XXI, p. 43 (type locality Diourbel, 150 km. E. of Dakar, Senegal).

Vidua paradisæa SWAINSON, 1837, 'Birds of West Africa,' I, p. 172 (Senegal).

ADULT MALE IN BREEDING DRESS.—The longest (=2d) pair of rectrices is band or ribbon-shaped to within a very short distance of the tip. Hind-neck of a light golden-brown color, very like that of the chest. Eighteen adult males give the following measurements: wing, 73–80; longest rectrices, 203–260. Care must always be taken in measuring the tail to ascertain, by examining the bases of the feathers, that it is fully grown.

SPECIMENS EXAMINED (adult males in breeding plumage).—Senegal: Diourbel, 3; Tieli, 3; Thiès, 1; Kirtaona, 1; "Senegal," 8. "Senegambia," 2. Gambia River, 2. "Sierra Leone," 1. French Sudan: Beledugu region, 2. Gold Coast Colony: Gambaga, 2. Northern Nigeria: near Sokoto, 2. Lake Chad territory: Zinder, 2. Shari River region: Abarin, 1; Gulfei, 1; Bahr Keta, 1. Ubangi region: Fort Sibut, 1.

DISTRIBUTION.—From Senegal and the French Sudan eastward to Lake Chad and the Shari River. On the south the limits appear to be fixed by the forests of the Guinea coast and the Cameroon. The specimen from "Sierra Leone" may not be accurately labeled. The easternmost representatives, collected by the second expedition of the Duke of Mecklenburg in the neighborhood of the Shari and Ubangi, are typical *aucupum*, for their longest tail feathers range from 203 mm. (Abarin)

¹1870, 'Vögel Ost-Afrikas,' p. 424.

to 260 mm. (Ft. Sibut). Throughout all this area *Steganura paradisæa* is unknown.

***Steganura aucupum longicauda*, new subspecies**

TYPE.—♂ ad. in breeding plumage, No. 161983, Amer. Mus. Nat. Hist.; Faradje, Uelle District, November 9, 1911 (Amer. Mus. Congo Exp.).

MEASUREMENTS OF THE TYPE.—Wing, 78 mm.; longest rectrices, 298; exposed culmen, 10.5; metatarsus, 17.

DESCRIPTION OF TYPE.—Coloration exactly as in the preceding form, the brown of the breast rather light, and of small extent, the feathers of the hind-neck of the same golden brown. The long rectrices are however much better developed than in *S. aucupum aucupum*, and in the two other males from Faradje they measure 284 and 295 mm., the wings being 78 and 79 mm.

SPECIMENS EXAMINED.—Upper Uelle district: Faradje, 2 immature males, and 3 adult males in breeding plumage.

DISTRIBUTION.—None of the male specimens seen in any other museum can be referred to this form, so that for the present it is known only from the region of Faradje on the Dungu River. I saw living birds in breeding plumage, however, at Niangara, on the Uelle River, and Aba, on the border of the Lado Enclave. That the range of the subspecies is even more extensive may be assumed from the fact that it is somewhat migratory, and found in the Upper Uelle only from early November to January. Probably the rest of the year is spent to the northward in the southern Bahr-el-Ghazal.

Here again the range is not known to be shared with *S. paradisæa*, although one specimen of the latter was collected by Emin at Lado.

***Steganura aucupum nilotica*, new subspecies**

TYPE.—♂ ad. in breeding plumage, No. 63579, Museum of Comparative Zoölogy; 10 miles above Abu Zor, Blue Nile, January 6, 1913. (Phillips Sudan Exp.)

MEASUREMENTS OF THE TYPE.—Wing, 78 mm.; longest rectrices, 217; exposed culmen, 10; metatarsus, 17.5.

DESCRIPTION OF TYPE.—Brown of the chest somewhat darker and more extensive than in *S. a. aucupum* and *longicauda*, whereas the whole hind-neck, in distinct contrast to the chest, is of a pale straw-yellow.¹ The tail feathers average much shorter than in either of the preceding races. The 12 adult males of *nilotica* measured by me give the following results: wing, 75–80 mm.; long rectrices, 191–224.

SPECIMENS EXAMINED (adult males in breeding plumage).—Eritrea: Mai Uassen, 1; Scetel, 1. "Abyssinia," 1. Sennar: Abu Usher, 1; Roseires, 5; 10 miles above Abu Zor, 1; Abu Haraz, 1; "Sennar," 1.

¹Wear and bleaching through exposure, in the other races of *aucupum*, sometimes cause the nape to become unusually yellow.

White Nile: Jebelein, 4; "White Nile," 1. Kordofan: Barra, near El Obeid, 1; "Kordofan," 3. "Sudan" (probably Kordofan), 1. "Bahr-el-Ghazal," 1. "Northeast Africa," 1.

DISTRIBUTION.—From Eritrea to the Blue and White Niles, Kordofan, and perhaps the northern Bahr-el-Ghazal. The eastern edge of its range is shared with *S. paradisæa*, but *nilotica* is either very rare or altogether wanting in Abyssinia.

***Steganura aucupum obtusa*, new subspecies**

TYPE.—♂ ad. in breeding plumage, No. 25812, collection of Mr. J. H. Fleming, Toronto; from Luchenza, Nyasaland (collected by Nisbet).

MEASUREMENTS OF THE TYPE.—Wing, 82 mm.; longest rectrices, 200; exposed culmen, 10; metatarsus, 14.

DESCRIPTION OF TYPE.—The brown of breast is as dark as in *paradisæa*, and consequently much more marked than in any other race of *aucupum*. There is, moreover, much the same contrast between the nape and chest as in *paradisæa*, for the hind-neck is yellow with very little trace of brown. On the other hand the long rectrices differ more than ever from those of *paradisæa*, for they are shorter and broader than in the other races of *aucupum*. In the type these feathers measure 35 mm. in width, and of course do not dwindle in size till close to the tip.

Measuring the width of the longest rectrices in a number of examples of each race of *aucupum*, I obtained the following figures: *aucupum*, 25–27; *longicauda*, 29–32; *nilotica*, 24–30; *obtusa*, 35–37. There is much the same difference in the width of the median pair of rectrices, for in the type of *aucupum*, I found them 23 mm. broad, and in a specimen of *obtusa* from Angola 35 mm. This median pair of tail feathers is usually entirely hidden by the second, greatly lengthened pair. Figures of the birds often show them too plainly, and this is equally true of the figure accompanying the present paper. It seemed desirable to indicate their length, otherwise only the upper borders and the hair-like tips, at most, should have been visible.

There is a good deal of variation in the color of the hind-neck of *obtusa*. In some skins, like the type, it is as yellow as in many *paradisæa*, but in others a distinct brownish wash is perceptible, probably when the feathers are freshest. The dark brown of the chest, often a deep chestnut, in combination with the broad, stubby tail feathers, makes it easy to recognize.

The 30 adult males I have measured have longer wings than any other group in the genus, 80–89 mm. Their tails were from 176 to 216 mm. in length.

The difference in length of wing which Sclater and Praed¹ pointed

¹1918, *Ibis*, p. 460.

out between paradise whydahs from southern and from northeastern Africa is to be explained as follows: in the British Museum there are many specimens of *S. a. obtusa* from the south, especially from Nyasaland, and these would bring up the average very considerably, even were the southern *paradisæa* included with them.

SPECIMENS EXAMINED (adult males in breeding plumage).—Kenya Colony: Escarpment, 1. Kivu district: Kibati, 1; Uvira, 1. "Tanganyika," 1. Manyema district: Munie Mboka, 1; Lubilu, 1; Dogodo, 1; Niembo, 1. Katanga district: Funda Biabo, 3; Lualaba River, 1; Kaluli River, 1. Northern Rhodesia: Petauke, 1. Nyasaland: Luchenza, 1; Mlanji, 3; Chiradzulu, 1; Mpimbi, 1; Namaramba Lake, 1; Ntondwe, 1; Fort Lister, 1; Zomba, 2; Lake Shirwa, 1; "Nyasaland," 1. Northern Gazaland, 1. Loanda: Pungo Andongo, 1. Mossamedes: Gambos, 1; Tuandiva, 1; Kasinga River, 1.

DISTRIBUTION.—The most northerly record known to me is that of a male collected by Doherty at Escarpment, Kikuyu Mts., Kenya Colony, but the bird must be uncommon in that part of East Africa. It has also been taken at Kibati, just north of Lake Kivu, by Pilette, and by Grauer at Uvira, on Lake Tanganyika. Southeast of the Congo forest it becomes more common; Pilette secured four more males in the Manyema district between Tanganyika and Kasongo, and they have been taken in the Katanga by Neave and by de Baillet-Latour. In Nyasaland this is the common paradise whydah, and numbers have been collected by Sharpe and Whyte. Angola has both *obtusa* and *verreauxii*, as shown by the collections made by Ansorge for Lord Rothschild. He obtained *obtusa* at Tuandiva, Gambos, and Pungo Andongo. A specimen of van der Kellen's is from the Kasinga River. In southeast Africa the species extends even farther than Lake Shirwa, for Swynnerton has taken a specimen in northern Gazaland.

***Steganura paradisæa* (Linnæus)**

Emberiza paradisæa LINNÆUS, 1758, 'Systema Nature,' 10th Ed., p. 178 (type locality Africa, restricted in 12th Ed. to Angola).

Vidua verreauxii CASSIN, 1850, Proc. Acad. Nat. Sci. Philadelphia, V, No. 3, p. 56 (Abyssinia).

Vidua sphænura BONAPARTE, 1850, 'Consp. Gen. Avium,' I, p. 449 (Abyssinia).

Steganura paradisea australis HEUGLIN, 1861, 'Forschungen über die Fauna des Rothen Meeres und der Somali-Küste,' Petermann's Mittheilungen, VII, p. 24 (Abyssinia, Danakil, and Somali coasts).

Vidua paradisea orientalis HEUGLIN, 1871, 'Orn. Nordost-Afrikas,' I, p. 583 (Northeast Africa).

ADULT MALE IN BREEDING DRESS.—The elongated second pair of rectrices has a characteristic outline, broad at the base but beginning to taper at less than one-half the length, and extending out as thin, pointed streamers. Their length is more variable than is usual in *S. aucupum*, but there the variation is not geographic. The brown of the breast is dark, and contrasts strongly with the straw-yellow of the hind-neck.

To make sure that northern and southern birds of this species were not separable, I have carefully compared their measurements. In 24 adult males from north of the equator (Eritrea to Kenya Colony) I find: wing, 76–81; long rectrices, 245–344. For 21 from south of the equator (Transvaal and Angola to Tanganyika Territory): wing, 76–83; long rectrices, 270–336.

SPECIMENS EXAMINED (adult males in breeding plumage).—Eritrea: Salomona, 1. Somaliland: Raia Wachali, 1; Smith River, 1. Abyssinia: Tadejemulka, 1; Koomeglee, 2; Dire Daoua, 3; Ourso, 12; Tertale, 3; Goura, 1; Furza, 1; Dire Ela, 3; Karaba, 1; Galla countries, 4; Darro Mts., 1; "Abyssinia," 3. Anglo-Egyptian Sudan: Sennar, 1; Mongalla, 9; Lado, 1. Kenya Colony: Baringo, 1; Muressi (Turkwell R.), 1; Mutias Mumomi, 1; Kerio River, 1; Manda Island, 1; Lamu, 1; Athi River, 1; S. E. Mt. Kenia, near Tana R., 1; Kitui, 1; Kibwesi, 1. "British E. Africa," 1. Tanganyika Territory: Morogoro, 1; Ukami, 1; Ugogo, 2; Dar-es-Salaam, 1; "Tanganyika," 1. Mozambique: Tette, 4. Angola: Loanda, 1. Mossamedes: Tuandiva, 1; Cavallana, 1; Catequero, 1; Chahivi, 2. Damaraland: Omaloko, 1. Southern Rhodesia: Bulawayo, 4; Nonyonko (?), 1; Tati, 1. Transvaal: Rustenberg, 5. Zululand: Etchowe, 2. Natal: Port Natal, 1. "South Africa," 1. (One specimen of *paradisæa* in the British Museum is labelled "R. Gambia, Whitely," but surely in error. The only specimen taken with certainty west of the White Nile is one collected at Lado by Emin Pasha.)

DISTRIBUTION.—From Eritrea across Abyssinia to Mongalla and Lado on the Upper White Nile, and to the coast of Kenya Colony. Thence southward to Tanganyika Territory, Southern Rhodesia, Angola, the Transvaal, and eastern Cape Colony. Thus in the north-east its range overlaps that of *S. aucupum nilotica*, and on the east and south to some extent with that of *S. aucupum obtusa*. It is possible that the two species have slightly different preferences as to haunts or food; but it is worth mentioning that at Tuandiva, in Mossamedes, Anson collected a male of each, both in breeding plumage, on the same day, March 16, 1906.

It will be noted that I have abandoned Cassin's name *verreauxii*,

which is a synonym of *paradisæa*. It is perfectly clear that it cannot be confused with *S. a. nilotica*, for I have examined Cassin's type of *verreauxii*, in the Philadelphia Academy. In case there may be any doubt as to the importance of the shape of the tail feathers, I may call attention to the fact that I have yet to see them of a shape intermediate between *aucupum* and *paradisæa*. Dr. A. G. Butler,¹ to be sure, does say that "The tail-plumes decrease in breadth, but increase in length with age." Fortunately he tells us just how much the increase was, 48 mm. in four annual molts; this is not as great as the variation I show for the subspecies of *aucupum*. If the shape of the feather-tip depended merely upon growth, then the *paradisæa* form should be found in northwest Africa. In other parts of the continent, where two forms do inhabit the same territory, one varies geographically, the other does not.

Nor is it probable that the two forms are Mendelian in character, interbreeding, yet preserving their distinctness. Far more probably the females will be found to show points of difference as well. In any event, the males in the eclipse plumage assumed each year do appear to be distinguishable. By comparing several specimens of *aucupum* in this plumage from Senegal and Zinder with others from parts of the continent where *paradisæa* alone has been found (southern Abyssinia especially), I found that *paradisæa* males in eclipse differ from those of *aucupum* in being generally darker above, the blackish markings predominating more over the rufous and buff. The light median crown-stripe is narrower in *paradisæa*, 4 mm. (as against 6-7.5 in *aucupum*), the black streaking on the back is much coarser, the upper tail coverts more blackish, and the middle pairs of rectrices apparently blacker and broader. The breast of *paradisæa* is even deeper cinnamon than that of *aucupum*, and it appears to be always more streaked. There are short triangular or arrow-shaped spots of blackish extending all across the chest.

This opinion as to the eclipse plumage of *paradisæa* is strengthened by Edwards' plate, which shows the same captive specimen of *paradisæa* in breeding and eclipse plumage. The spotted chest is very noticeable in the latter, whereas in undoubted males of *aucupum* there are only the faintest traces of spots. About the differences between females I cannot be so confident, but am inclined to think that here, too, *paradisæa* is more spotted on the chest. Most of the brown birds in collections are either females or young males, rarely adults in eclipse.

¹1894, 'Foreign Finches, in Captivity,' pp. 282, 283.

Now let us see whether any explanation can be offered for the origin and present distribution of these five forms of paradise whydah. I shall not attempt to offer final proof, but simply a plausible hypothesis. From what I know of these birds in the wild state, they abhor rain-forest. Living on grass seeds, burdened with enormous tail feathers during a large

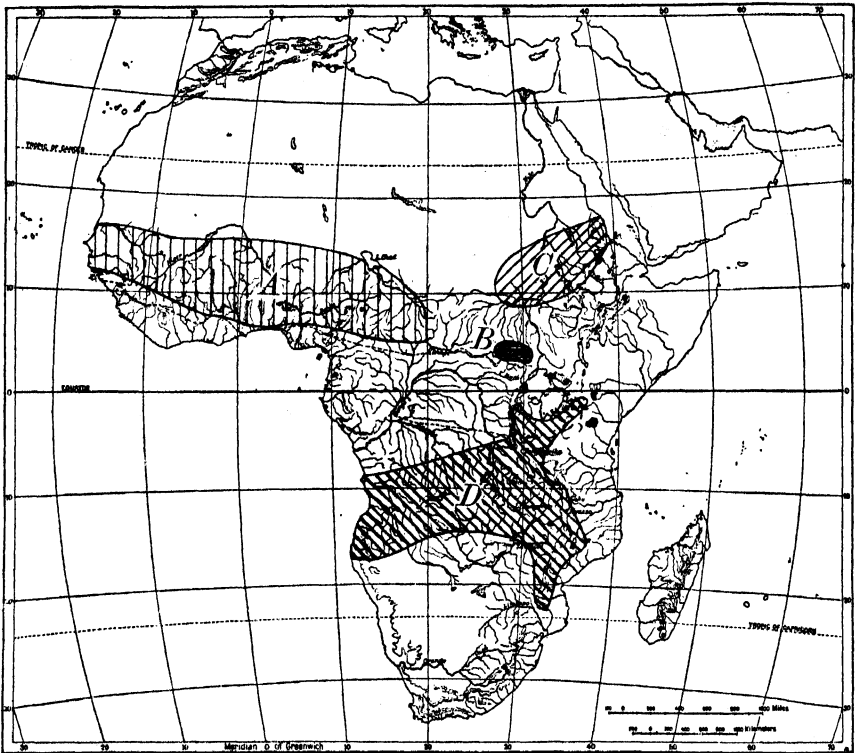


Fig. 2. Approximate areas occupied by the subspecies of *Steganura aucupum*.

A.—*S. a. aucupum*; B.—*S. a. longicauda*; C.—*S. a. nilotica*; D.—*S. a. obtusa*. The ranges of the first three, however, will probably be found to meet in the region north of the Ubangi River.

part of the year, they are most at home in a short-grass plain, with a few trees as lookouts for the wary males. This is sufficient not only to show why they are found only in savannas and steppes, but even to give us a hint as to the probable inception of the two species. One cannot avoid being impressed by the importance of isolation in the past evolution of birds. This, more than any other influence, seems to have facilitated the origin of new forms, whether subspecies, species, or genera. I do not say "caused," for the cause may be something quite different.

The probable reason for the isolation of the paradise whydahs was the greater extension of the equatorial forest at some time in the past, in eastern Africa. Many botanists hold this to be extremely likely. It is my belief that *Steganura aucupum* was then restricted to the grasslands north of the forest, where it still monopolizes more than half the width of

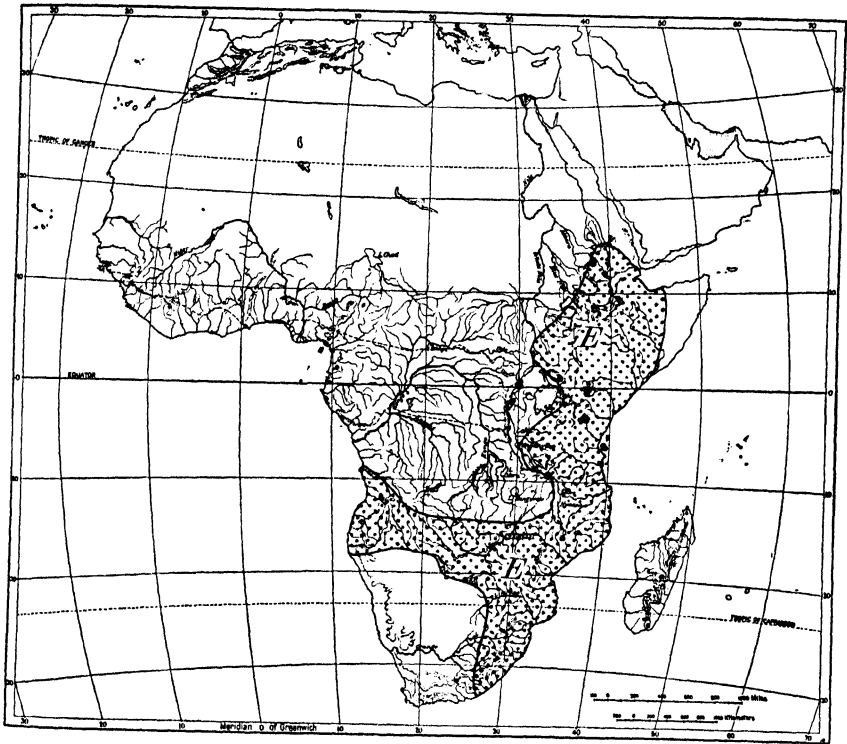


Fig. 3. Approximate distribution of *Steganura paradisæa*.

the continent, and that *S. paradisæa* occupied those of the south. Then came the reduction of the forest to the east, but the two species were already so differentiated that when *aucupum* extended southward, and *paradisæa* northward into Abyssinia, they did not interbreed. There is no longer complete segregation, and yet we still see the same influences at work in the case of *S. aucupum*, with its widely scattered populations. They stretch over a vast area, and are still partially isolated by the Congo forests, with the result that slight differences in coloration, and in the dimensions of the wing and tail, have already begun to appear.

Steganura paradisæa is still homogeneous; even wing-length will not distinguish northeastern specimens from southern. A glance at the map will show how much less the Congo forest intercepts its distribution. If my assumption is correct, that *aucupum* and *paradisæa* no longer interbreed, it will be a good example of the slight external characters that suffice to hold allied species apart. Such differences in the shape of the tail may well have arisen by mutation, but their extension to a species as a whole must, I feel sure, be favored by this sort of isolation.

In some similar manner, in the more remote past, the related genera *Tetrænura*, *Linura*, and *Vidua* may have had their beginning, first as allied species—even now they are scarcely valid genera—under the influence of some condition affecting intercommunication. Once differences had been established that would forestall interbreeding, the birds might again spread into one another's areas. Why the stocks, once isolated, should tend to diverge is a question far beyond the scope of this paper; but I believe it to be the case.

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59 84,2 (460 9)

DESCRIPTION OF A NEW RACE OF THE LESSER BLACK-BACKED GULL, FROM THE AZORES

BY JONATHAN DWIGHT

A series of seventeen gulls from the Azores, recently acquired for The American Museum of Natural History, has been kindly placed at my disposal by Dr. L. C. Sanford. I am also indebted to Mr. Outram Bangs of the Museum of Comparative Zoölogy for the loan of two other gulls from the Canary Islands. These birds are strikingly different from any of the hitherto described races of *Larus fuscus* and, as the dates of capture range from August 22 to March 10, it is probable that they represent a form resident upon these islands and upon others off the African coast. For this reason I have named them after the fabled island or islands of Atlantis.

Larus fuscus atlantis, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Larus fuscus affinis* but larger, the legs, feet and bill heavier, and the mantle a paler "light neutral" gray, instead of "deep neutral gray."

MEASUREMENTS.—Male: wing, 427; tail, 175; tarsus, 68; toe without claw, 58; claw, 10; culmen, 55; depth of bill at base, 19.5; at angle, 20.5.

TYPE.—No. 14304, collection of L. C. Sanford; ♂ ad.; March 10, 1922; Fayal Azores; J. G. Correia.

SPECIMENS EXAMINED

Larus fuscus atlantis, Azores, 8 ♂, 6 ♀, 3 juv.; Canary Islands, 1 ♂, 1 juv.

Larus fuscus fuscus, 6 ♂, 3 ♀, 2 juv.; 6 not sexed.

Larus fuscus affinis, 5 ♂, 4 ♀, 1 juv.; 5 not sexed.

Larus fuscus taimyrensis, 1 ♀.

Compared with *affinis*, the nearest race both in color and in distribution, the mantle of *atlantis* is a clearer, paler, bluer gray without any of the brownish tinge that marks all the other races even in perfectly fresh plumage, and, furthermore, when adult males are compared with males, and females with females, the average larger size is obvious.

Larus fuscus fuscus is a dark neutral gray often quite fuscous, browner with wear, almost as dark as *Larus marinus*; the race *affinis* is a deep neutral gray, very slightly brown-tinged, and of the same shade as *Larus occidentalis livens*; the race *taimyrensis* seems to be merely a large

affinis; while *atlantis* is the palest gray of any and similar in shade to *Larus occidentalis occidentalis*.

One may well wonder if this new race does not represent the birds that Godman years ago called *argentatus* in listing those of the Canaries and Madeira (Ibis, 1872, p. 222), having seen them in June on the Azores (Ibis, 1866, p. 103). Later writers have referred such birds to *cachinnans* (*leucophæus*), among them Ogilvie-Grant (Ibis, 1890, p. 444) and Lowe ('British Birds,' VI, 1912-13, p. 5); but without examination of actual specimens, I should be loth to exclude this species from the Atlantic fauna where it has been repeatedly recorded by a number of reliable observers.

Like *fuscus* and its races, *cachinnans* when adult has yellow feet, but the wing-pattern is quite different; *argentatus* and its races have flesh-colored feet, but again the wing-pattern is different from that of either *fuscus* or *cachinnans*. Those who have available specimens would do well to settle the question whether *cachinnans*, a species of more eastern distribution, breeds much west of the Black Sea region.

		Wing	Tail	Tarsus	Toe With- out Claw	Toe With Claw	Culmen	Bill Depth at Base	Bill Depth at Angle
Type No. 14304	♂	427	175	68	58	68	55	19.5	20.5
14305	♂	428	178	68	58	68	57	18	19
14307	♂	422	171	67	54	65	57	18.5	20
14306	♂	420	175	65	56	65	54	18.5	20.5
14309	♂	425	164	66	54	64	56	18	19
14308	♂	420	162	66	56	65	56	19	20
14310	♂	422	168	66	55	65	53	18	19.5
14311	♂	412	171	67	57	66	54	18	19
M. C. Z. No. 69036	♂	428	167	67	56	66	54	19.5	20.5
Average		422.7	169.8	66.6	56.0	65.8	55.1	18.5	19.8
14312	♀	406	165	66	53	60	54	18	19
14313	♀	405	164	61	52	61	48	17	18.5
14314	♀	398	164	60	51	59	49	16	18
Brwdoin College	♀	405	170	59	51	60	48	17	18
14315	♀	397	153	62	53	62	50	16.5	18
14316	♀	395	158	62	54	61	53	17	18
Average		401.0	162.3	61.7	52.3	60.5	50.3	16.9	18.3

Specimen numbers refer to the collection of L. C. Sanford, except where otherwise noted. Measurements are in millimeters.

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59.57,96(729.8)

THE ANTS OF TRINIDAD¹

BY WILLIAM MORTON WHEELER

Since the publication of my paper (Bull. Mus. Comp. Zool., LX, 1916, pp. 323-330, 1 fig.) on the ants collected in Trinidad by Prof. Roland Thaxter I have seen considerable additional material from the same locality. Dr. F. E. Lutz has recently sent me for study a series of specimens taken by Mr. P. B. Whelpley and contributed to The American Museum of Natural History, and Mr. F. W. Urich has sent me several interesting forms, among them a singular cave-ant which proves to belong to an undescribed genus. I have also found some species hitherto unrecorded from the island in a vial of miscellaneous sweepings received from Prof. Thaxter. During July 1920, while on my way to British Guiana, I was able, through the courtesy of Mr. W. G. Freeman, Director of Agriculture, Department of Trinidad and Tobago, to collect a number of species in the Botanical Garden near Port of Spain and at Caroni and Diego Martin. After studying this additional material it seems advisable to list the Formicidæ known to occur in the island. I have therefore included all the older records of species taken by Mr. Urich and Prof. Forel, who collected at Port of Spain while on his voyage to Colombia in 1896. The nearly 150 different forms taken to date furnish additional proof, if it were needed, that the ant fauna of Trinidad, unlike that of the various Windward Islands and Tobago, is in great part identical with and probably quite as rich as that of the adjacent Venezuelan coast.

FORMICIDÆ

Dorylinæ

Eciton burchelli Westwood.—Port of Spain, (R. Thaxter), ♂, ♀; Diego Martin, (Wheeler), ♂, ♀.

Eciton burchelli var. **urichi** Forel.—Trinidad, (Urich); Port of Spain, (R. Thaxter), ♂, ♀; Caparo and Port of Spain, (P. B. Whelpley), ♀.

Eciton (Labidus) crassicornis F. Smith.—Matura, (Urich); Port of Spain, (R. Thaxter); Caparo and Port of Spain, (P. B. Whelpley), ♀.

¹Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University. No. 207.

Eciton (Acamatus) pilosum F. Smith.—Aripa Savanna, (R. Thaxter); Port of Spain, (P. B. Whelpley), ♀.

Eciton (Acamatus) adnepos, new species¹

WORKER.—Length, 1.5–1.7 mm.

Practically monomorphic. Head subrectangular, nearly one-third longer than broad, slightly broader in front than behind, its sides very feebly and evenly convex, its posterior border broadly and deeply excised, its posterior corners rounded. Eyes represented by minute white spots at the middle of the sides. Mandibles short, narrow, their apical borders not very oblique, straight, somewhat acute at the tip but toothless. Clypeus very short and depressed, its anterior border very feebly sinuate in the middle. Antennæ stout, scapes reaching the middle of the head, incrassate apically; first funicular joint a little longer than broad, succeeding joints, especially the basal, strongly transverse, the ninth and tenth nearly as long as broad, the terminal twice as long as broad and blunt at the tip. The three last joints really form a club. Thorax narrow, laterally compressed; the pro- and mesonotum together three times as long as the base of the epinotum, very feebly and evenly convex, the pronotum with a strong transverse carina just behind the neck. Mesoepinotal constriction feeble but distinct; epinotum small, its base, apart from the constriction, continuing the dorsal curve of the pro- and mesonotum and separated on each side from the short and concave declivity by a small angle; the sides of the declivity submarginate. Petiole about one and one-half times as long as broad, very convex above, with a large blunt protuberance at its anterior ventral end. Postpetiole slightly broader than long, but little broader than the petiole and less convex above, with a small, acute, transverse anteroventral projection. Gaster smaller than the head, elongate-elliptical. Legs rather stout; tarsal claws simple.

Very smooth and shining, except the meso- and metapleuræ which are very finely punctate and slightly opaque. Mandibles sparsely and finely punctate, piligerous punctures on the remainder of the body very minute and scattered.

Hairs pale yellow, uneven, rather short, coarse, moderately abundant, erect or suberect both on the body and appendages.

Head and thorax yellowish red; mandibles and meso- and metapleuræ darker; petiole, postpetiole, gaster, antennæ and legs yellow.

Described from 15 specimens taken from a small army which I found traversing the threshold of one of the fern-houses in the botanical garden at Port of Spain.

This minute species is quite distinct from any known to me in nature or from descriptions in the shape of the head, mandibles, pedicel, etc.

PONERINÆ

Platythyrea angusta Forel.—Trinidad (type-locality), ♀.

Prionopelta punctulata Mayr subsp. **antillana** Forel.—Savanna, (A. Forel), ♀.

¹Types of new species described in this paper will be deposited in The American Museum of Natural History

- Ectatomma tuberculatum** Olivier.—Port of Spain and Sangre Grande, (R. Thaxter), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.
- Ectatomma ruidum** Roger.—Port of Spain, (R. Thaxter), ♀; Chaguanas, (Urich), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.
- Ectatomma (Gnamptogenys) concinnum** F. Smith.—Caparo, (P. B. Whelpley), ♀.
- Ectatomma (Holcoponera) brasiliense** Emery.—Port of Spain, (P. B. Whelpley), ♀.
- Ectatomma (Holcoponera) striatulum** Mayr var. **pleurodon** Emery.—Trinidad, (Urich), ♀.
- Neoponera obscuricornis** Emery var. **latreillei** Forel.—Caura, (Urich), ♀.
- Neoponera unidentata** Mayr.—Port of Spain, (R. Thaxter), ♀.
- Pachycondyla crassinoda** Latreille.—Port of Spain, (R. Thaxter), ♀, ♀; Caparo, (P. B. Whelpley), ♀.
- Pachycondyla harpax** Fabricius.—Port of Spain, (R. Thaxter), ♀.
- Pachycondyla impressa** Roger.—Port of Spain, (R. Thaxter), ♀; Botanical Garden, (Wheeler), ♀.
- Euponera (Mesoponera) constricta** Mayr.—Trinidad, (A. Forel), ♀; Port of Spain, (R. Thaxter), ♀, ♀; Montserrat, (Aug. Busck), ♀.
- Euponera (Mesoponera) laevigata** F. Smith variety **whelpleyi**, new variety
- A single worker taken by P. B. Whelpley at Caparo seems to represent a distinct variety of this rare ant. Each side of the petiole has a large and conspicuous patch of parallel striæ like those on the sides of the epinotum but slanting from above downwards and backwards. I find no mention of these striæ in Smith's original description or in Emery's re-description of the typical form under the name of *Pachycondyla gagatina*.
- Euponera (Trachymesopus) stigma** Fabr.—Port of Spain, (R. Thaxter), ♀, ♀.
- Ponera opaciceps** Mayr.—Aripa Savanna, (R. Thaxter), ♀.
- Ponera trigona** Mayr var. **opacior** Forel.—Port of Spain, (R. Thaxter), ♀, in sweepings.
- Leptogenys unistimulosa** Roger var. **trinidadensis** Forel.—Trinidad, (Urich), type locality, ♀.
- Anochetus inermis** Ern. André.—Trinidad, (A. Forel), ♀, ♂.
- Anochetus inermis** var. **meinerti** Forel.—Chaguanas, (Urich), ♀; Port of Spain, (R. Thaxter), ♀, ♀, ♂.
- Anochetus targionii** Emery.—Caparo, (P. B. Whelpley), ♀.
- Anochetus (Stenomyrmex) emarginatus** Fabr.—Trinidad, (Urich), ♀; Port of Spain, (R. Thaxter), ♀; Ariopita Valley, (B. D. Chipman),

Odontomachus hæmatoda L.—Port of Spain, Gasparee Island and Sangre Grande, (R. Thaxter), ♂, ♀; Botanical Garden, Port of Spain, (Wheeler), ♂.

Odontomachus hæmatoda subsp. **insularis** Guérin var. **hirsutiusculus** F. Smith.—Port of Spain, (R. Thaxter), ♂.

Odontomachus hæmatoda L. subsp. **meinerti** Forel.—Port of Spain, (R. Thaxter), ♂.

Pseudomyrmæ

Pseudomyrma championi Forel var. **paulina** Forel.—Port of Spain, (Aug. Busck; R. Thaxter), ♂.

Pseudomyrma elegans F. Smith subsp. **breviceps** Forel.—Savanna, (A. Forel), type-locality, ♂; Trinidad, (A. Busck), ♂; Botanical Garden, Port of Spain, (Wheeler), ♂.

Pseudomyrma elongata Mayr.—Trinidad, (A. Forel), ♂; Port of Spain, (P. B. Whelpley), ♂.

Pseudomyrma flavidula F. Smith.—Port of Spain, (P. B. Whelpley), ♂.

Pseudomyrma gracilis Fabr.—Port of Spain, (P. B. Whelpley), ♂; Botanical Garden, Port of Spain, (Wheeler), ♂.

Pseudomyrma culmicola Forel.—Trinidad, (A. Forel), type-locality, ♂.

Pseudomyrma excavata Mayr.—Port of Spain, (R. Thaxter), ♂; Botanical Garden, Port of Spain, (Wheeler), ♂.

Pseudomyrma filiformis Fabr.—Trinidad, (Urich), ♂.

Pseudomyrma kuenckeli Emery.—Trinidad, (Urich); Botanical Garden, Port of Spain, (Wheeler), ♀.

Pseudomyrma nigropilosa Emery subsp. **laticeps** Forel.—Trinidad, (A. Forel), type-locality, ♂.

Pseudomyrma pallida F. Smith.—Aripa Savanna, (R. Thaxter), ♂; Trinidad, (Urich), ♂.

Pseudomyrma icterica, new species

WORKER.—Length, nearly 6 mm.

Head subrectangular, about one-fifth longer than broad, as broad in front as behind, with feebly convex sides and feebly and broadly excised posterior border; in profile convex above and below. Mandibles moderately convex, with two larger apical and several minute basal teeth. Clypeus bluntly carinate behind, its border broadly sinuate on each side, with a distinct rectangular lobe, rounded at the corners. Frontal carinæ small, closely approximated; frontal groove feeble. Eyes moderately large and convex, about two-fifths the length of the sides of the head. Antennal scapes reaching the middle of the head; first funicular joint a little longer than broad, second broader than long, remaining joints slightly longer than broad, terminal joint longer. Thorax rather narrow; the pro- and mesonotum together a little longer than the epinotum; the mesoepinotal constriction abrupt, rather long and deep, its im-

pressed surface longitudinally striated. Pronotum as long as broad, with rather flattened sides, rounded above and at the humeri. Mesonotum semicircular, broader than long. Epinotum with the base sloping backward, twice the length of the declivity into which it passes through a rounded obtuse angle. Petiole stout, with short peduncle and thick node, the latter rising rather abruptly in front. Seen from above it is as broad as long, with rounded sides and posterior border and straight anterior border; the sides almost submarginate, the ventral surface with a very small acute, downwardly directed spine near its anterior end. Postpetiole nearly a third again as broad as the petiole, broader than long, narrowed and constricted anteriorly, its sides posteriorly and its dorsal surface convex and rounded. Gaster rather large, of the usual shape. Fore femora dilated and somewhat flattened and rhomboidal; hind femora somewhat swollen.

Mandibles opaque, striatopunctate apically, smoother at the base; remainder of the body smooth and shining; anterior half of head finely and rather densely punctate and subopaque, punctures on the remainder of the body sparse and very fine.

Hairs pale yellow, very sparse, erect, rather evenly scattered over the head, thorax and abdomen; pubescence very fine and dense on the gaster but apparently lacking elsewhere.

Yellow; teeth and borders of mandibles, postpetiole, and gaster, except at last segment, brown; the second and third segments of the gaster darker. Legs somewhat paler than the head and thorax.

A single specimen taken by Mr. August Busck at Port of Spain. I describe this and the following species as new because they are distinctly different from any of the forms of which I have seen specimens or descriptions.

***Pseudomyrma auripes*, new species**

FEMALE (deälated).—Length, about 8 mm.

Head subrectangular, about one-sixth longer than broad, slightly narrowed in front, with rounded sides and posterior corners and nearly straight posterior border, in profile somewhat flattened in the frontal region. Mandibles stout, flattened, with a pronounced protuberance, or knee, in the outer border near the base; apical border with two strong terminal and no basal teeth. Clypeus carinate in the middle, broadly notched on each side, the median lobe long and narrow with acute corners. Frontal carinae rather long and not closely approximated; frontal groove very fine and indistinct. Eyes rather flat, only about one-third as long as the sides of the head. Antennal scapes short, thickened distally, reaching only to the margins of the cheeks when placed transversely; first funicular joint one and one-half times as long as broad, remaining joints, except the last, twice as broad as long, except the second joint which is less abbreviated. Thorax long, narrower through the wing-insertions than the head. Epinotum in profile with the base but little longer than the declivity. Petiole short, scarcely twice as long as broad, the peduncle very indistinct, the node evenly rounded, broadest just behind the middle, bluntly submarginate above on the sides below and anteriorly with a large, flattened, hook-like, downwardly and backwardly directed spine. Postpetiole about one-fourth broader than the petiole, broader than long, hemispherical, not constricted anteriorly but evenly convex and rounded dorsally and laterally. Its ventral surface is also convex and bears a small,

acute tooth at the anterior end. Gaster elongate, the pygidium pointed, the hypopygium laterally compressed. Legs stout.

Smooth and shining; the mandibles coarsely rugose-punctate. Anterior portion of head very finely and superficially, the remainder of the body much more sparsely punctate.

Hairs pale yellowish, pubescence whitish; the former sparse and erect, short on the head, longer and more abundant on the pedicel and gaster. Pubescence very dilute and indistinct, except on the sides of the epinotum where it is sufficiently dense to give the surface a pruinose appearance.

Black; mandibles, sides of clypeus and borders of cheeks castaneous; antennæ, wing-insertions, tips of femora, tibiæ, tarsi, spine on ventral surface of petiole, and ventral and lateral borders of gastric segments, yellow; antennal scapes and median portions of middle and hind tibiæ brown.

Described from a single specimen which I found running on a tree-trunk in the Botanical Garden near Port of Spain. This species is apparently related to the series of plant-inhabiting *Pseudomyrmas* comprising *Ps. arboris-sanctæ* Emery, *latinoda* Mayr, *tachigaliæ* Forel, *damnosa* Wheeler, *triplaridis* Forel, etc.

Myrmicinæ

Pheidole biconstricta Mayr subsp. **socrates** Forel.—Trinidad, (Urich),
♂, ♀.

Pheidole cornutula Emery.—Botanical Garden, Port of Spain, (Wheeler),
♂.

Pheidole subarmata Mayr var. **borinquenensis** Wheeler.—Botanical
Garden, Port of Spain, (Wheeler), ♂.

Pheidole fallax Mayr subsp. **jelskii** Mayr.—Trinidad, (Urich, Forel),
♂, ♀.

Pheidole fallax subsp. **jelskii** Mayr var. **antillensis** Forel.—Botanical
Garden, Port of Spain, (Wheeler), ♂, ♀.

Pheidole flavens Roger subsp. **gracilior** Forel.—Trinidad, (A. Forel),
♂, ♀.

Pheidole flavens subsp. **sculptior** Forel.—Trinidad, (Urich), ♂, ♀.

Pheidole susannæ Forel subsp. **obscurior** Forel.—Trinidad, (A. Forel).

Pheidole lacerta, new species

SOLDIER.—Length, 2.3 mm.

Closely related to *Ph. bicornis* Forel of Panama. Head about one-fifth longer than broad, as broad in front as behind, its anterior angles small and very acute, the sides feebly convex, the posterior border rather deeply excised, but the occipital groove short and shallow; the frontal groove absent. Eyes rather small and feebly convex, at the anterior fourth of the sides. Gula in front with two prominent teeth. Mandibles not very convex, with two larger apical and two minute basal teeth. Clypeus short, concave and ecarinate, its anterior border nearly straight in the middle. Frontal carinæ large, suberect and prominent, but not acute, forming the inner borders of distinct, though flattened scrobe-like depressions. Antennæ small and slender;

scapes not incrassated and not reaching to the middle of the sides of the head; club as long as the remainder of the funiculus; joints 2-8 very short, transverse and subequal. Pro- and mesonotum together forming a subhemispherical mass with indistinct humeri; the declivity of the mesonotum with a very feeble indication of a transverse torus behind; mesoepinotal constriction pronounced. Epinotum small, longer than broad, the base in profile horizontal and distinctly longer than the sloping declivity, the spines short and acute, directed upward and outward and slightly backward. Petiole from above scarcely broader behind than in front, the node with a transverse, entire border. Postpetiole about half again as broad as the petiole, broader than long and broadest in front where its sides are bluntly angular. Gaster elongate-elliptical, as large as the head. Legs rather short and not very robust.

Mandibles and clypeus smooth and shining, the former with small scattered, elongate punctures. Head and thorax subopaque, the head transversely rugose above, more reticulate-rugose laterally and in the occipital region, the scrobes finely and densely punctate. The gula is also reticulate but more loosely and finely and its sides are smooth and shining. Thorax and petiole very finely and densely punctate, the pronotum also transversely rugulose above. Postpetiole, gaster and legs smooth and shining, with fine, sparse, piliferous punctures.

Hairs yellowish, delicate, short and suberect on the head and moderately abundant, erect and much longer on the thorax, pedicel and gaster, very short and appressed on the appendages.

Ferruginous red; antennæ and legs yellow.

A single specimen swept from foliage near Port of Spain by Prof. Roland Thaxter.

This species, though closely related to *Ph. bicornis* Forel, seems, nevertheless, to be sufficiently distinct. The Central American species is considerably larger (3.2-3.3 mm.), its clypeus is carinate, its frontal carinæ are pointed as in *Ph. cornutula*, the humeri of the pronotum are more pronounced, the petiolar node is emarginate at the summit, the sculpture is coarser, especially on the thorax, and the color is paler.

***Pheidole tenerescens*, new species**

SOLDIER.—Length, 2.2 mm.

Allied to *Ph. minutula* Mayr. Head large, rectangular, scarcely longer than broad, as broad in front as behind, with straight, parallel sides, the posterior border somewhat more deeply excised than in *minutula*, the dorsal and gular surfaces decidedly less convex. Occipital groove very short and shallow; frontal groove absent. Gula anteriorly with two small, acute teeth. Mandibles convex, with two distinct apical teeth. Clypeus moderately convex in the middle but ecarinate, the anterior border straight. Eyes small and rather flat, nearly circular, near the anterior fourth of the head. Frontal area large, shallow, subelliptical. Frontal carinæ short, diverging. There are no scrobes nor scrobe-like depressions for the antennæ. The latter are slender; scapes reaching nearly to the middle of the sides of the head; the funiculi long, the club as long as the remainder of the funiculus, joints 2-8 small, distinctly shorter than long. Thorax shaped much as in *minutula*; the pro- and mesonotum together forming a large hemispherical mass, with distinct though blunt humeral angles; the mesonotum descending behind abruptly to the mesoepinotal

constriction. Epinotum subcuboidal, as broad as long, its base as long as the declivity, the spines small, short and acute, directed upward, not half as long as the distance between their bases. Petiole small, less than twice as long as broad, the node blunt and rounded, not compressed anteroposteriorly. Postpetiole scarcely broader than the petiole, a little broader than long, its sides and dorsal surface rounded. Gaster smaller than the head, broadly elliptical. Legs rather short.

Smooth and shining; the anterior half of the head longitudinally rugulose, the rugules being faint and not very dense; the posterior half of the head with very sparse, piligerous punctures. Epinotum superficially and densely punctate or finely reticulate.

Hairs white, very fine, rather short, suberect, moderately abundant on the body, finer and more appressed on the legs; scapes with a few erect longer hairs on their anterior surfaces.

Honey-yellow; head and mandibles a little darker.

A single specimen taken by Prof. Thaxter near Port of Spain in sweepings.

This form is sufficiently distinct from *Ph. minutula* in the more flattened and much more feebly sculptured head, the smaller eyes, less compressed petiolar node, shorter and sparser pilosity, paler coloration, etc.

Pheidole (Macropheidole) fimbriata Roger.—Port of Spain, (R. Thaxter), ♂, ♀; Caparo, (P. B. Whelpley), ♂, ♀, ♀.

Pheidole (Decapheidole) decem Forel.—Trinidad, (A. Forel), type-locality, ♂.

Crematogaster brevispinosa Mayr var. **minutior** Forel.—Botanical Garden, Port of Spain, (Wheeler), ♀. Nesting in accumulations of carton around spines of two trees of *Acacia cornigera*.

Crematogaster (Orthocrema) brasiliensis Mayr.—Aripa Savanna and Sangre Grande, (R. Thaxter), ♀.

Crematogaster (Orthocrema) limata F. Smith.—Port of Spain, (R. Thaxter), ♀, in sweepings.

Crematogaster (Orthocrema) limata subsp. **parabiotica** Forel.—Trinidad, (Urich), ♀; Port of Spain and Gasparee Island, (R. Thaxter), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Monomorium floricola Jerdon.—Trinidad, (Urich), ♀; Port of Spain, (R. Thaxter), ♀.

Magalomymex bituberculatus Forel.—Arima, (Urich), ♀; Port of Spain, (R. Thaxter), ♀.

Tranopelta gilva Mayr.—Port of Spain, (Aug. Busck), ♀ ♂.

Solenopsis altinodis Forel.—Trinidad, (Urich), ♀; Port of Spain, (R. Thaxter), ♀, in sweepings.

Solenopsis basalis Forel var. **urichi** Forel.—Trinidad, (Urich), type-locality, ♀, ♀.

Solenopsis tenuis Mayr.—Port of Spain, (R. Thaxter), ♂.

Solenopsis minutissima Emery.—Trinidad, (R. Thaxter), ♂.

Solenopsis geminata Fabr.—Port of Spain, (R. Thaxter), ♂; Chaguanas (Urlich), ♂; Port of Spain, (P. B. Whelpley), ♂; Botanical Garden, Port of Spain, (Wheeler), ♂.

SPELÆOMYRMEX, new genus

WORKER.—Very small, monomorphic. Head moderately large, with convex sides and concave posterior border. Mandibles narrow, their apical borders very oblique, with a few large teeth. Clypeus very short, except in the middle, where it extends back between the frontal carinæ, the anterior border sinuous in the middle and on each side with a broad tooth, and with two carinæ which curve outwards anteriorly and form sharp borders for the antennal sockets. Frontal groove and area absent; frontal carinæ small, short and lobular. Eyes minute, in front of the middle of the head; ocelli absent. Antennæ 11-jointed, the funiculi with a very distinct 2-jointed club, as long as the remainder of the funiculus, the terminal joint very long, the first joint also long and stout compared with joints 2-8, which are small and shorter than broad. Thorax rather slender, with very distinct mesoëpinotal constriction, angular humeri and the epinotum armed with spines. There is no promesonotal suture. Petiole small, elongate, pedunculate, with a conical node, the ventral surface unarmed. Postpetiole with a very low node. Gaster much smaller than the head, the first segment very large, truncated anteriorly, the remaining segments small and short. Legs long, the femora and tibiæ slender basally, clavate distally, the middle and hind tibiæ without spurs; tarsal claws simple.

GENOTYPE.—*S. urichi*, new species.

Spelæomyrmex urichi, new species

Figure 1

WORKER.—Length, 1.5 mm.

Head scarcely longer than broad, as broad in front as behind, with evenly convex sides and broadly excised posterior border; in profile somewhat more flattened above than below. Mandibles moderately large, with convex external borders and the oblique apical borders furnished with four large, subequal teeth. Clypeus steep and convex in the middle, depressed on the sides. Eyes consisting of only a few minute, indistinct, pigmented facets, placed at the anterior third of the head. Antennæ rather long, their scapes reaching to about half the distance between the eyes and the posterior corners of the head. Basal joint of the funiculus fully twice as long as broad and much longer than joints 2-7, which are fully twice as broad as long, the eighth joint nearly as long as broad; basal joint of club longer than broad, terminal joint three times as long as the basal and rather pointed at the tip. Thorax much narrower than the head, the pro- and mesonotum depressed and very feebly rounded above in profile, the humeri distinctly angular, the inferior angles of the pronotum blunt. Mesoëpinotal constriction abrupt and rather long. Epinotum much narrower than the pronotum, subrectangular, broader than long, its base longer than broad, the spines flattened, triangular, somewhat longer than broad, acute, shorter than their distance apart at the base and directed upward and backward. Petiole twice as long as broad, broadened behind, the conical node circular when seen from above and rising rather abruptly from the peduncle, the ventral surface of the segment feebly

convex anteriorly. Postpetiole in profile but little more convex dorsally than ventrally, from above trapezoidal, about twice as broad behind as in front, with straight anterior, posterior and lateral borders. Gaster elliptical, its anterior border straight and transverse, angulate at the sides. Basal halves of femora slender, apical halves incrassated; tibiae, especially the middle and hind pairs, of similar shape.

Subopaque; mandibles coarsely rugose-punctate; sides of clypeus and the cheeks longitudinally rugose; remainder of head, thorax, petiole, and postpetiole reticulate-rugose; middle of clypeus, a large, elongate area just behind the frontal

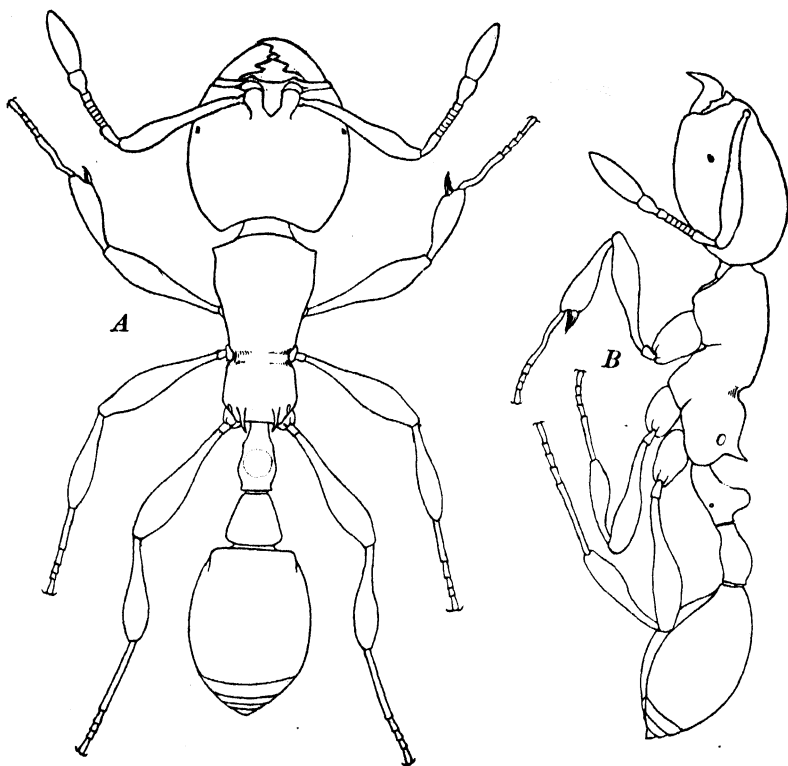


Fig. 1. *Spelæomyrmex urichi*, new genus and new species. Worker. A, dorsal; B, lateral aspect.

carinae, the nodes of the petiole and postpetiole, the gaster and appendages very smooth and shining, with minute, sparse, piligerous punctures. The meshes of the reticulation on the postero-lateral portions of the head and on the pronotum are looser and more longitudinal than on the epinotum and the ventral portions of the petiole and postpetiole.

Hairs pale yellowish, bristly, erect, rather abundant, uneven, covering the body and appendages, conspicuously long on the clypeus, legs, gaster and nodes of petiole and postpetiole. Pubescence absent.

Ferruginous; the antennae, legs, gaster and nodes of the petiole and postpetiole yellow.

Described from eleven specimens found by Mr. F. M. Urich living in the guano of the fat-bird (*Steatornis caripensis* Humboldt) in the Guacharo Cave of Trinidad. The pale color, very minute eyes and long bristly pilosity indicate that this is a true cavernicolous ant. It evidently runs down to the tribe Pheidologetini Emery in our tables and is very closely related to *Erebomyrma* Wheeler, but differs markedly in a number of characters, notably in the much larger size of the head, the angulate humeri, the shape of the petiole, postpetiole and legs and the much greater size of the first gastric segment. The discovery of the probably very large male and female phases will probably show that we are concerned either with a very distinct genus or a highly aberrant species of *Erebomyrma*. Perhaps the Texan *E. longi* Wheeler, which is certainly subterranean and has been taken only once (during a nuptial flight), is really a cavernicolous ant. At any rate search should now be made for it in the bat-guano which often accumulates in great masses in many of the caves of Texas.

Leptothorax (Goniothorax) asper Mayr.—Port of Spain, (P. B. Whelpley), ♀.

Leptothorax (Goniothorax) tristani Emery.—Port of Spain, (R. Thaxter), ♀, in sweepings.

Wasmannia auropunctata Roger.—Trinidad, (A. Forel), ♀, ♂; Port of Spain, (R. Thaxter), ♀, ♀; Botanical Garden, Port of Spain, (Wheeler), ♀; Guacharo Cave, (Urich), in nesting materials of guacharo (*Steatornis caripensis* Humb.), ♀.

Procryptocerus spiniperdus Forel.—Trinidad, (Urich), type-locality, ♀; Port of Spain, (P. B. Whelpley), ♀, ♀.

The female measures nearly 7 mm. and is very similar to the worker but with the pronotum coarsely and evenly reticulate-rugose and the longitudinal rugæ on the mesonotum and base of epinotum coarser. The epinotal spines are stouter and proportionally shorter.

Cryptocerus maculatus F. Smith.—Trinidad, (R. Thaxter), ♀.

Cryptocerus maculatus subsp. **nanus** Forel.—Savanna, (A. Forel) type-locality, ♀; Port of Spain, (P. B. Whelpley), ♀; same locality (R. Thaxter), ♀, in sweepings.

Cryptocerus umbraculatus Fabr.—Port of Spain, (P. B. Whelpley), ♀.

Cryptocerus pusillus Klug.—Aripa Savanna, (R. Thaxter), ♀.

Cryptocerus spinosus Mayr.—Botanical Garden, Port of Spain, (Wheeler), ♀.

Cryptocerus (Zacryptocerus) clypeatus Fabr.—Sangre Grande, (R. Thaxter), ♀; Port of Spain, (U. S. Nat. Mus.), ♀.

Cephalotes atratus L.—Trinidad, (A. Forel), ♀; Port of Spain, (R. Thaxter, P. B. Whelpley, Wheeler), ♀.

Strumigenys eggersi Emery.—Verdant Vale, (Urich), ♀; Port of Spain, (R. Thaxter), ♀, in sweepings.

Strumigenys saliens Mayr.—Port of Spain, (R. Thaxter), ♀.

Strumigenys trinidadensis, new species

WORKER.—Length, nearly 3 mm.

Closely related to *S. saliens* Mayr but smaller. Head and mandibles of the same shape and proportions but the occipital excision deeper and the mandibles flatter. The teeth are of the same number and in the same position but differ in length; the denticle at the base of the apical tooth is much smaller and the two on the inner border of the mandibles are very short and acute, the proximal shorter than the distal. Antennal scapes slender, reaching to the beginning of the occipital lobes as in *saliens*; first funicular joint as long as joints 2 and 3 together, which are subequal and distinctly longer than broad; joint 4 nearly as long as joints 1 to 3 together and scarcely more than half as long as the terminal joint. Thorax shaped as in *saliens*, but pro- and mesonotum with a slender, sharp median carina. Epinotum with both superior and metasternal spines, the former somewhat longer than the latter and about half as long as the base of the epinotum, without membranous expansion below. Petiole and postpetiole similar to those of *saliens* but the peduncle of the former passing much more gradually into the distinctly lower node. Postpetiole broader than in *saliens*, being nearly twice as broad as the petiolar node. The spongiform masses arranged much as in *saliens* but less developed along the ventral surface of the petiole.

Opaque; finely and densely punctate, postpetiole and ventral and apical portions of the gaster smoother and more shining; head more coarsely, pronotum more finely rugose, the rugæ irregular and longitudinal. Gaster very finely and indistinctly shagreened, its extreme base with a regular row of radiating rugules.

Hairs whitish; those on the anterior border of scapes curved and clavate and in a regular series. There are a few erect clavate hairs on the head and thorax and the head has also more numerous small, scattered appressed and rather indistinct scale-like hairs; those on the petiole, postpetiole and gaster are fine, long, erect, abundant and flexuous; mandibles and legs with short, delicate, appressed hairs.

Yellowish brown; mandibles, legs and gaster more yellowish; the teeth on the inner borders of the mandibles black.

Described from a single specimen swept from foliage near Port of Spain by Prof. Roland Thaxter.

This ant is readily distinguished from *S. saliens* by its considerably smaller size, paler color, shorter mandibular teeth, carinate pro- and mesonotum, more finely punctate and more coarsely rugose head and pronotum, lower petiolar node and different abdominal pilosity. It is less closely related to *S. silvestrii* Emery, which is much smaller, paler, with much less deeply excised head and lacks the metasternal spines, though the arrangement of the mandibular teeth is similar.

Codiomyrmex thaxteri Wheeler.—Port of Spain, (R. Thaxter), type-locality, ♀, in sweepings.

Sericomyrmex urichi Forel.—Trinidad, (Urich), type-locality, ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Apterostigma mayri Forel.—Trinidad, (Urich), type-locality, ♀; Diego Martin, (Wheeler), ♀, ♀, ♂, fungus gardens under logs in cacao plantation.

Apterostigma urichi Forel.—Trinidad, (Urich), type-locality, ♀; Caparo, (R. Thaxter), ♀.

Apterostigma wasmanni Forel.—Four Roads, Port of Spain, (R. Thaxter), ♀.

Myrmicocrypta squamosa F. Smith.—Port of Spain, (A. Forel), ♂.

Mycocepurus smithi Forel.—Diego Martin, (Urich), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Cyphomyrmex rimosus Spinola.—Botanical Garden, Port of Spain, (Wheeler), ♀, ♀, ♂.

Cyphomyrmex rimosus subsp. **minutus** Mayr.—Botanical Garden, Port of Spain, (Wheeler), ♀.

Trachymyrmex cornetzi Forel variety **bivittatus**, new variety

WORKER.—Differing from the typical form from Colombia in having the pale-brownish cloud on each side of the first gastric segment replaced by a very definite dark-brown band, which reaches to the base of the segment and is continued as a band of the same color on the side of the postpetiole. There is no infuscation of the pronotum, but the antennal club, except the tip of its last joint, is dark brown.

Numerous workers from two colonies which I found in the Botanical Garden, Port of Spain (type-locality) and at Coroni. In both places the nests were in clay banks and resembled those of our North American *T. septentrionalis* McCook. I have taken the typical *cornetzi* at Kartabo in British Guiana. Forel has described from Colombia a variety, *naranjo*, which is more reddish and with an even feebler development of the brown clouded areas than in the typical form of the species.

Trachymyrmex humilis Wheeler.—Gaspree Island and Port of Spain, (R. Thaxter), type-locality, ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Trachymyrmex urichi Forel.—Trinidad, (Urich), type-locality, ♀; Ariopita Valley, (B. D. Chipman), ♀; Gaspree Island, (R. Thaxter), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Acromyrmex octospinosus Reich.—Trinidad, (Günther, Urich, A. Forel), ♀, ♀, ♂; Gaspree Island, (R. Thaxter), ♀; Ariopita Valley, (B. D. Chipman), ♀; Port of Spain, (P. B. Whelpley), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀.

Atta cephalotes L.—Port of Spain and Sewa Valley, (R. Thaxter), ♀ ; Taberguilla and Port of Spain, (P. B. Whelpley), ♀ .

Dolichoderinæ

Dolichoderus attelaboides Fabr.—Arima, (Urich), ♀ ; Port of Spain, (R. Thaxter), ♀ .

Dolichoderus decollatus F. Smith.—Port of Spain, (R. Thaxter), ♀ .

Dolichoderus (Monacis) bispinosus Olivier.—Port of Spain, (R. Thaxter), ♀ , ♀ , ♂ ; Erin, (Urich), ♀ ; Caparo, (P. B. Whelpley), ♀ ; Caroni and Botanical Garden, Port of Spain, (Wheeler), ♀ .

Dolichoderus (Monacis) debilis Emery.—Matura, (Urich), ♀ ; Sangre Grande, (R. Thaxter), ♀ .

Dolichoderus (Hypoclinea) bidens L.—Tamana, (Urich), ♀ ; Botanical Garden, Port of Spain, (Wheeler), ♀ .

Dolichoderus (Hypoclinea) bidens var. **spurius** Forel.—Trinidad, (Urich), type-locality, ♀ .

Dolichoderus (Hypoclinea) championi Forel var. **tæniatus** Forel.—Savanna, (A. Forel), Port of Spain, (R. Thaxter), ♀ ; Botanical Garden, Port of Spain, (Wheeler), ♀ .

Dolichoderus (Hypoclinea) championi subsp. **trinidadensis** Forel.—Trinidad, (Urich), type-locality, ♀ ; Port of Spain, (R. Thaxter), ♀ .

Dolichoderus (Hypoclinea) lutosus F. Smith.—Savanna, (A. Forel), ♀ .

Iridomyrmex dispartitus Forel subsp. **micans** Forel.—Port of Spain, (R. Thaxter), ♀ .

Azteca alfaroi Emery subsp. **lucidula** Forel.—Trinidad, (Urich), ♀ , ♀ , ♂ ; Caroni and Botanical Garden, Port of Spain, (Wheeler), ♀ , ♀ , in internodes of *Cecropia peltata*.

Azteca barbifex Forel.—Port of Spain, (R. Thaxter), ♀ .

Azteca bicolor Emery subsp. **belti** Emery.—Botanical Garden, Port of Spain, (Wheeler), ♀ , running on trunks of *Cecropia peltata*.

Azteca chartifex Forel.—Trinidad, (Urich), type-locality, ♀ ; Arima, (Urich).

Azteca chartifex subsp. **decipiens** Forel var. **lanians** Forel.—Arima, (Urich), ♀ , ♀ ; Botanical Garden, Port of Spain, (Wheeler), ♀ , from large, pendent, carton nests on rubber trees.

Azteca constructor Emery.—Botanical Garden, Port of Spain, (Wheeler), ♀ , ♀ , nesting in internodes of *Cecropia peltata*.

Azteca delpini Forel subsp. **trinidadensis** Forel.—Trinidad, (Urich), type-locality, ♀ , ♀ ; Caroni, (Wheeler), nesting in internodes of *Cecropia peltata*.

- Azteca foreli** Emery subsp. **ursina** Forel.—Trinidad, (Urich), type-locality, ♀, ♂; Chatham, (Urich), ♀.
- Azteca jelskii** Emery.—Trinidad, (Urich), ♀, ♀.
- Azteca trigona** Emery subsp. **mathildæ** Forel var. **spuria** Forel.—Botanical Garden, Port of Spain, (Wheeler), ♀.
- Azteca trigona** subsp. **mediops** Forel.—Port of Spain, (R. Thaxter), ♀; Ariopita Valley, (H. D. Chapman), ♀.
- Azteca velox** Forel.—Arima, (Urich), ♀.
- Azteca velox** Forel var. **nigriventris** Forel.—Port of Spain, (R. Thaxter), ♀.
- Azteca xanthochroa** Roger.—Caroni, (Wheeler), ♀, nesting in internodes of *Cecropia peltata*.
- Tapinoma melanocephalum** Fabr.—Aripa Savanna, (R. Thaxter), ♀; Port of Spain, (P. B. Whelpley), ♀.
- Tapinoma ramulorum** Emery var. **saga** Forel.—Trinidad, (Urich), type-locality, ♀, ♀.
- Tapinoma ramulorum** subsp. **irrectum** Forel var. **cearense** Forel.—Trinidad, (Urich), ♀, ♂.

Formicinæ

- Brachymyrmex heeri** Forel.—Port of Spain, (R. Thaxter), ♀, in sweepings.
- Brachymyrmex minutus** Forel.—Trinidad, (Urich), ♀.
- Prenolepis (Nylanderia) longicornis** Latr.—Sangre Grande, (R. Thaxter), ♀.
- Prenolepis (Nylanderia) cæciliæ** Forel.—Caparo, (P. B. Whelpley), ♀.
- Prenolepis (Nylanderia) steinheili** Forel.—Port of Spain, (P. B. Whelpley), ♀.
- Prenolepis (Nylanderia) vividula** Nyl.—Port of Spain, (R. Thaxter), ♀.
- Prenolepis (Nylanderia) vividula** subsp. **guatemalensis** Forel var. **itinerans** Forel.—Trinidad, (Urich), ♀.
- Camponotus (Dinomyrmex) agra** F. Smith.—Platanal, (Urich), ♀; Caparo, (P. B. Whelpley), ♀.
- Camponotus (Myrmothrix) abdominalis** Fabr.—Trinidad, (A. Forel); Port of Spain, (R. Thaxter, P. B. Whelpley), ♀; Ariopita Valley, (B. D. Chipman), ♀; Botanical Garden, Port of Spain, (Wheeler), ♀, ♀.
- Camponotus (Myrmothrix) femoratus** Fabr.—Port of Spain, (R. Thaxter), ♀.
- Camponotus (Myrmosphincta) urichi** Forel.—Trinidad, (Urich), type locality, ♀.

Camponotus (Myrmobrachys) auricomus Roger.—Botanical Garden, Port of Spain, (Wheeler), ♀.

Camponotus (Myrmobrachys) beebei Wheeler.—Near Port of Spain, (R. Thaxter), ♀.

Camponotus (Myrmobrachys) brettessi Forel.—Trinidad, (A. Forel), ♀.

Camponotus (Myrmobrachys) canescens Mayr.—Botanical Garden, Port of Spain, (Wheeler), ♀.

Camponotus (Myrmobrachys) excisus Mayr.—Port of Spain, (R. Thaxter), ♀.

Camponotus (Myrmobrachys) godmani Forel variety **palliolatus**, new variety

Six minor workers taken near Port of Spain by Prof. R. Thaxter agree closely with Forel's description of the types from Mexico and Central America, except that the tibiae, upper surfaces of the femora and upper surface of the thorax are dark brown; the pigment on the pronotum being aggregated in two large, rather indefinite spots. The posterior portion of the head seems also to be more extensively infuscated than in the typical form.

Camponotus (Myrmobrachys) lindigi Mayr.—Gaspree Island, (R. Thaxter), ♀.

Camponotus (Myrmobrachys) senex F. Smith.—Port of Spain, (R. Thaxter, P. B. Whelpley), ♀.

Camponotus (Myrmobrachys) zoc Forel.—Trinidad, (A. Forel); Ariopita Valley, (B. D. Chipman), ♀.

Camponotus (Myrmamblys) novogrenadensis Mayr.—Botanical Garden, Port of Spain, (Wheeler), ♀.

Camponotus (Myrmocladocus) rectangularis Emery var. **setipes** Forel, —Trinidad, (Urich), type-locality, ♀.

Camponotus (Myrmocladocus) latangulus Roger.—Port of Spain, (R. Thaxter), ♀.

Camponotus (Myrmocladocus) bidens Mayr.—Port of Spain, (R. Thaxter), ♀.

Camponotus (Pseudocolobopsis) claviscapus Forel.—Trinidad, (Urich), type-locality, ♀, ♂.

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A NEW GENUS AND SUBGENUS OF MYRMICINÆ FROM TROPICAL AMERICA¹

BY WILLIAM MORTON WHEELER

MYRMECINELLA, new genus

WORKER.—Small, monomorphic, with hard integument. Head somewhat flattened, moderately large. Mandibles convex, subtriangular, with well-developed, dentate apical border. Clypeus with a convex and projecting, subrectangular, bicarinate, median lobe, the sides depressed and feebly emarginate; the median portion not extending far back between the frontal carinae. Eyes rather small, well in front of the middle of the head; ocelli absent. Frontal area distinct; frontal groove absent; frontal carinae short and lobular. Antennae 11-jointed; the funiculi with a large basal joint and a large 3-jointed club, the terminal joint of which is very large; joints 2 to 5 very short and transverse. Thorax small, considerably narrower than the head; the pro- and mesonotum convex and rounded above and at the humeri, without promesonotal suture above; mesoepinotal constriction deep and selliform; epinotum unarmed. Petiole very small, epedunculate, subcuboidal, without a node, unless a strong and prominent, anterior, transverse ridge, terminating in a tooth on each side be regarded as such. Postpetiole very small, rounded. Gaster elliptical, nearly as large as the head, the first segment forming about half its surface. Legs with incrassate femora and tibiae, the middle and hind tibiae without spurs; tarsal claws simple.

FEMALE AND MALE.—Unknown.

GENOTYPE.—*M. panamana*, new species.

Myrmecinella panamana, new species²

Figure 1

WORKER.—Length, 2 mm.

Head a little longer than broad, slightly narrower in front than behind, with rounded sides and posterior corners and feebly sinuate posterior border; the dorsal surface on each side and posteriorly slightly impressed for the accommodation of the antennae but scarcely scrobe-like. Eyes flattened, near the anterior third of the head. Mandibles apparently 5-toothed, the two apical teeth large, the others small and rather indistinct. Clypeal lobe feebly notched in the middle, with marginate sides and rather sharp corners. The two clypeal carinae are continued back a short distance onto the front between the frontal carinae. Frontal area small, triangular, not impressed. Antennal scapes not reaching the posterior corners of the head; funicular joints 2-7 small, subequal, much broader than long; joint 8 larger and about as

¹Contributions from the Entomological Laboratory, Bussey Institution, Harvard University. No. 208.

²Types of new species described in this paper will be deposited in The American Museum of Natural History.

broad as long but much smaller than the second joint of the club, which is distinctly longer than broad; terminal joint nearly twice as long as the preceding joint. The whole club is slightly longer than the remainder of the funiculus. Promesonotum somewhat longer than broad, subhemispherical in profile; epinotum narrower than the promesonotum, longer than broad, its base in profile straight and horizontal, slightly lower than the promesonotum and as long as the rather abrupt declivity into which it passes through a distinct angle. Petiole from above nearly square, the

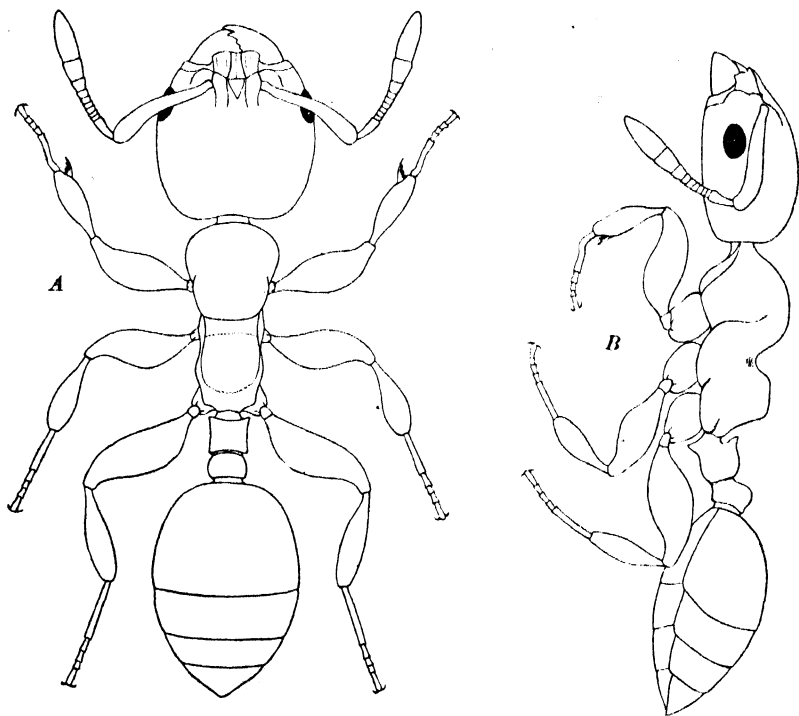


Fig. 1. *Myrmecinella panamana*, new genus and new species. Worker. A, dorsal; B, lateral aspect.

sides feebly concave, the posterior corners nearly as sharp as the anterior corners which are formed by the ends of the peculiar, straight, transverse ridge; ventral surface with a large, triangular, downwardly directed tooth. Postpetiole as broad as the petiole but much shorter, nearly twice as broad as long, very convex and rounded above. Gaster rather flattened. Legs robust, with the femora, especially the fore and hind pairs, conspicuously thickened.

Mandibles shining, sparsely punctate; head, thorax, petiole and postpetiole subopaque. Clypeus with a few sharp longitudinal rugæ. Front and sides of head punctate and finely, longitudinally rugulose; the longitudinal mid-dorsal third, from the front to the occiput very smooth and shining, with very minute, sparse, piliger-

ous punctures. Thorax, petiole and postpetiole very evenly and finely reticulate-rugose. Gaster, antennal scapes and legs smooth and shining.

Hairs white, very delicate, sparse, subappressed, short and inconspicuous on the head, thorax and appendages, longer on the gaster.

Castaneous brown; mandibles, antennæ, pedicel and legs slightly paler, more yellowish brown.

Described from two specimens which I found running on the bark of a living tree at Colon, Panama.

The genus *Myrmecinella* evidently belongs in Emery's tribe Myrmecini, the type genus of which is *Myrmecina*, represented by several species in the Palearctic, Oriental, Papuan, Australian and Nearctic Regions. To the same tribe Emery assigns nine other genera, namely, *Podomyrma*, *Lordomyrma*, *Atopomyrmex*, *Dilobocondyla*, *Tertaner*, *Atopula*, *Pristomyrmex*, *Acanthomyrmex* and *Dacryon*, all of which are confined to the Ethiopian, Oriental, Papuan and Australian Regions. *Myrmecinella* is therefore the only genus of the tribe that has come to light in tropical America. In its very small size and other characters it may be easily distinguished from any of the above-mentioned Old World genera.

PHEIDOLE subgenus **HENDECAPHEIDOLE**, new subgenus

While writing the description of *Pheidole tachigalia*, recently published in 'Zoologica' (Vol. 3, 1921, pp. 148-150), an ant which occurs in the leaf-petioles of *Tachigalia paniculata* Aublet and, as I have recently found, also in the stem-swellings of *Cordia nodosa* Lam. var. *hispidissima* Fres., I failed to count the antennal joints. I now find the number to be 11 in the soldier (Fig. 2A), worker, and female. The male is unknown, but Mr. Alfred Emerson has recently sent me another closely related undescribed species, represented by worker (Fig. 2B), female and male specimens. The male (Fig. 2C) also has 11-jointed antennæ, though the third funicular joint is long and shows a slight constriction in the middle on one side, indicating a fusion of two joints. It thus becomes necessary to place these two species in a new subgenus, which I will call *Hende apheidole*, intermediate between *Pheidole*, *sensu stricto*, with 12-jointed antennæ in the soldier, worker and female and 13-jointed antennæ in the male, and the subgenus *Decapheidole* Forel, which has 10-jointed antennæ in the soldier and worker. The male *Decapheidole* is unknown. The species of both of the subgenera are very small in all four phases compared with the species of *Pheidole*, *sensu stricto*. I regard *Pheidole tachigaliæ* as the type of the subgenus *Hendecapheidole*. A description of the undescribed species, taken by Mr. Emerson and dedicated to him, is appended.

Pheidole (Hendecapheidole) emersoni, new species

WORKER.—Length, 1.3–1.6 mm.

Head subrectangular, as broad as long, scarcely narrower in front than behind, with nearly straight lateral and feebly emarginate posterior borders. Apical borders of mandibles with numerous minute, uneven teeth. Clypeus moderately convex, with entire, transverse anterior border. Frontal area distinct, elongate; frontal groove absent; frontal carinae very small and short. Eyes moderately convex, situated just in front of the middle of the head, their ommatidia large and rather few in number. Antennal scapes almost reaching the posterior corners of the head; first funicular joint fully twice as long as broad; second joint as long as broad, joints 3–7 shorter, club longer than the remainder of the funiculus, its two basal joints distinctly

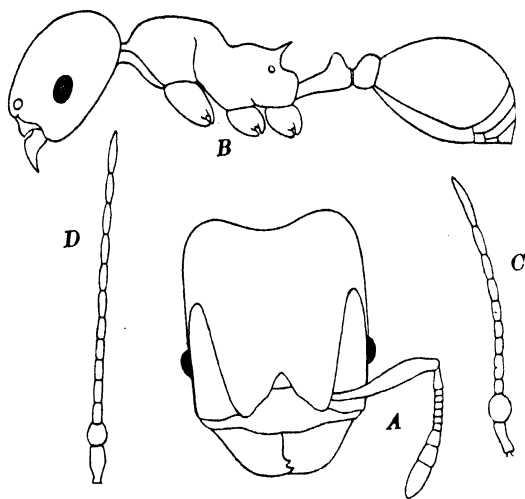


Fig. 2. A, *Pheidole (Hendecapheidole) tachigalix* Wheeler, head of soldier; B, *Pheidole (Hendecapheidole) emersoni*, new species; C, antenna of male of same species; D, antenna of male of *Pheidole pilifera* Roger.

longer than broad, together slightly shorter than the large terminal joint. Thorax similar to that of the *tachigalix* worker, the pro- and mesonotum forming a single convex mass, without suture or transverse welt, but the humeri are rounded and not prominent as in *tachigalix*. Mesoepinotal constriction short and deep; epinotum small, the base convex in profile, not longer than the declivity, the spines straight, acute, longer than broad at their bases but shorter than their distance apart, directed upward, outward and backward. Petiole small and slender, fully twice as long as broad and scarcely broader behind than in front, its sides straight and subparallel the node rather low but somewhat compressed anteroposteriorly, its border blunt and entire. Postpetiole small, only slightly broader than the petiole, broader than long, evenly rounded dorsally and laterally. Gaster oval, convex above, the anterior border of the first segment straight and transverse in the middle. Legs of the usual shape.

Mandibles smooth and shining; clypeus, head, thorax, petiole and ventral portion of postpetiole opaque, densely, finely and evenly punctate, or reticulate-rugulose; postpetiolar node, gaster, legs and antennal scapes smooth and shining.

Hairs whitish, long, erect and moderately abundant both on the body and appendages.

Brown; first gastric segment castaneous; head darker than the thorax and pedicel; mandibles, antennæ and legs brownish yellow.

FEMALE (deâlated).—Length, 2.3 mm.

Head shaped like that of the worker, but with more pronounced posterior corners and feeble scrobe-like impressions for the antennæ. Mandibles large and convex. Clypeus convex, with straight anterior border. Frontal area small, transverse, impressed. Eyes decidedly longer than their distance from the anterior margin of the head; gula with two acute teeth on its anterior border. Antennal scapes reaching only to about two-thirds the distance from the anterior to the posterior corners of the head. Thorax narrower than the head; broadly elliptical, the mesonotum and scutellum much flattened, the epinotal spines short, stout and acute. Petiole resembling that of the worker, but the anterior slope of the node is much less concave; postpetiole fully a third broader than the petiolar node, broader than long and broadest through the anterior corners, which are acute and projecting. Gaster elongate-elliptical, fully twice as long as broad; its anterior border concave.

Mandibles smooth and shining; clypeus, head, thorax, petiole and postpetiole opaque, finely and densely punctate, the scutellum and postpetiolar node smooth and shining. Clypeus indistinctly rugulose on the sides; head longitudinally rugulose, except on the scrobes, which are merely punctate. Gaster shining, with distinct, scattered, piligerous punctures. Similar punctures occur also on the scutellum and among the fine punctures of the mesonotum.

Hairs grayish and more abundant but in other respects much as in the worker.

Castaneous; mandibles and clypeus red; antennæ and legs brownish yellow.

MALE.—Length, 2.2–2.3 mm.

Head, excluding the eyes, longer than broad, broadly elliptical, not narrower in front than behind, flattened above. Eyes large, very close to the anterior border, less than half as long as the head. Mandibles small, spatulate, edentate. Clypeus feebly and evenly convex, with straight anterior border. Antennæ short, 11-jointed; scape very short, scarcely longer than the swollen, elliptical first funicular joint; third funicular joint twice as long as the second, with a transverse impression in the middle on one side; two succeeding joints each a little longer than the second funicular, the more apical joints longer, the last twice as long as the penultimate. Thorax long, broader than the head through the mesonotum which is convex anteriorly and flattened behind, without Mayrian furrows. Epinotum small, convex, its base and declivity scarcely distinct. Petiolar node very low, the postpetiole a little broader, as long as broad, not convex above and with rather straight sides. Gaster elongate-elliptical, with very distinct cerci. Legs slender. Wing venation as in typical *Pheidole*.

Opaque; very finely and densely punctate; gaster, mesopleuræ, mandibles, antennæ and legs smooth and shining; nodes of petiole and postpetiole also rather smooth.

Pilosity grayish and similar to that of the female but shorter. Wings also minutely hairy throughout, their posterior borders with long cilia.

Head and mesonotum black; remainder of body piceous, except the mandibles, antennæ, legs and genitalia, which are smoky yellowish. Mouth-parts whitish. Wings infuscated, with brown veins and pterostigma, the latter darker.

Described from numerous workers, a female and eight males taken by Mr. Alfred Emerson from a single colony nesting in a small cell within a termite nest at Kartabo, British Guiana. The species is close to *tachigaliæ*, but the females can be readily distinguished by striking differences in size, color, sculpture, and the development of the antennal scrobes. The worker *emersoni* is much darker than that of *tachigaliæ* and has the promesonotum more rounded above and with much less prominent humeri.

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TWO NEW SUBGENERA OF NORTH AMERICAN BEES

By T. D. A. COCKERELL

PERDITA Smith

Although bees have been collected for many years in the vicinity of Boulder, Colorado, it has remained for Dr. Frank E. Lutz to discover one of the most interesting and peculiar forms which exists in this region. On June 5, 1922, in the immediate vicinity of White Rocks, not far from Boulder, Dr. Lutz observed that the flowers of *Opuntia greenei* evidently contained some insects, revealed by the movements of the stamens. Expecting to find beetles, he parted the masses of stamens, and extracted numbers of small bees. Others of the same species were caught flying around. On June 13, the spot was revisited, and Mrs. Cockerell, Dr. Lutz, and his son obtained an additional supply of these bees. Both sexes were represented in about equal numbers. On making microscopical mounts, cleared in caustic potash, it was found that both males and females had eaten large quantities of *Opuntia* pollen, which could be seen in the abdomen.

The bees belong to the genus *Perdita*, in the broad sense, but are so peculiar that they must be considered typical of a new subgenus which, according to the views of some authors should rather rank as a full genus. In dealing with the segregates from *Perdita*, one meets with very excellent characters which appear to be of generic value, but they are modified and combined in various ways, so that it becomes difficult to know how to define and limit the possible series of genera. Either we must recognize a number of small or monotypic genera for aberrant species, or we must apparently divide the group into somewhat arbitrarily defined units, into which certain forms will fit with difficulty. No doubt the tendency will be to recognize more genera at the expense of the old aggregate *Perdita* and, if the present insect is then considered to typify a distinct genus, no great harm will be done.

LUTZIELLA, new subgenus

Bees of the genus *Perdita*, peculiar in the following characters, or combination of characters. Mandibles simple in both sexes, but longer and more curved in the male. Labial palpi four-jointed, the first much longer than the other three combined. Maxillary palpi six-jointed, more than half the length of the blade; second joint longest.

Stigma narrow and lanceolate. Marginal cell long for *Perdita*, obliquely truncate. First recurrent nervure ending some distance BEFORE first intercubitus. Claws with an inner tooth in both sexes. Spurs on middle and hind legs pectinate, curved at end, in both sexes. Second ventral segment of male with a broad thickening on apical margin. Margin of fifth dorsal segment of male with a series of stout finely pubescent spine-like structures, actually modified bristles. Apex of male abdomen with a pair of widely separated elongate lobes, which are actually on the sixth segment. Sting palpi well developed, with long plumose hairs at end, but apparently the sting is not functional, as it is short and not very acute; the sheath is narrow and elongate, emarginate at apex.

Type.—*Perdita (Lutziella) opuntiae*, new species.

The details of the genitalia will be discussed at another time, in connection with a more general study of the Panurgidæ. The figures drawn by Miss Elizabeth McKay, from dissections made by her, bring out other interesting structural characters.

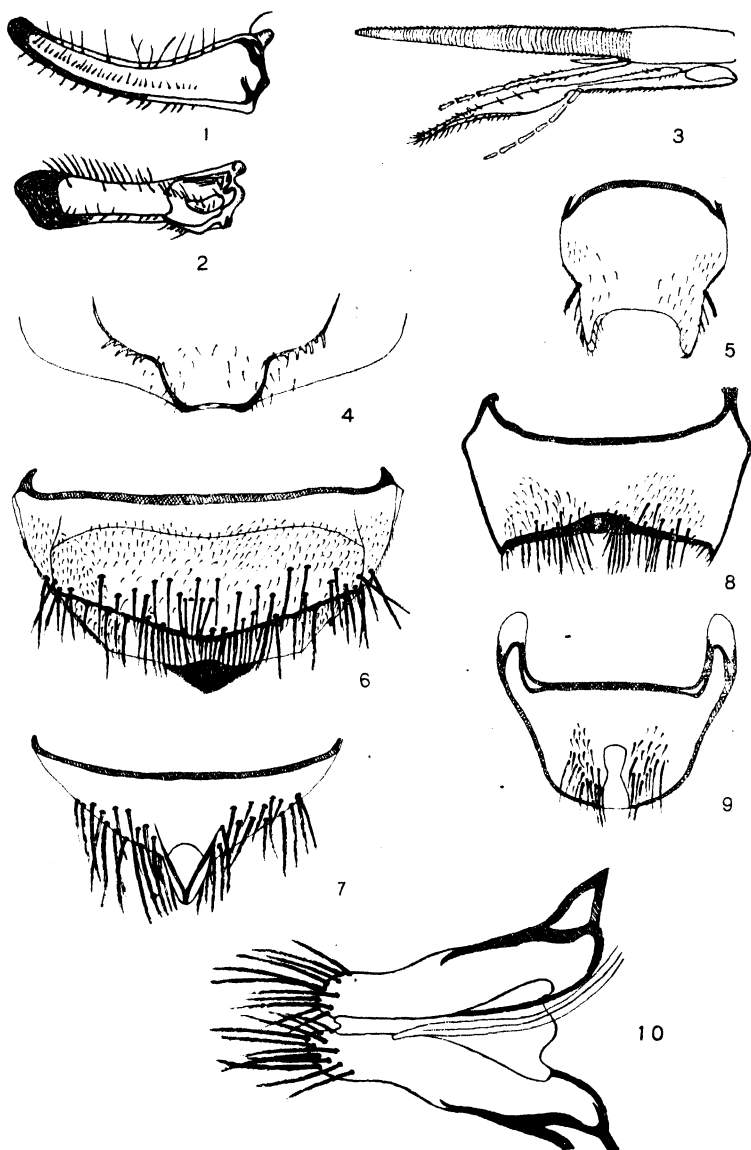
***Perdita (Lutziella) opuntiae*, new species**

Figures 1 to 10

♂. (Type).—Length 5.5 mm.; robust, with broad abdomen; head very large and broad, quadrate, the eyes diverging below; the broad and low clypeus (except minute dots and slightly reddish lower margin), lateral face-marks filling the broad space between clypeus and eye and sending a dentiform process a short distance up orbits, labrum, and mandibles except reddened apex, all cream-color; head otherwise black, the front and vertex dullish, the occiput and cheeks shining; antennæ rather short, pale reddish below, dark above; ocelli small; head and thorax with thin white hair; thorax black, the tubercles brownish; mesothorax polished, extremely finely punctured; mesopleura dullish; metathorax fringed on each side with white hair, its surface mainly dull, but the upper corners of the truncation swollen and shining; tegulæ reddish; wings hyaline, nervures and stigma pale brown; stigma narrow and lanceolate; marginal cell large, unusually long for a *Perdita*, broadly obliquely truncate; basal nervure falling very far short of nervulus; first recurrent nervure ending some distance before first intercubitus; femora dark, but coxæ and trochanters reddish; tibiæ dark, the anterior ones light reddish in front; tarsi pale reddish; abdomen entirely very bright ferruginous, a large dusky spot at each side of first segment sub-basally; surface of abdomen polished and shining; apex with a pair of widely separated long dentiform lobes; second ventral segment with the margin thickened and somewhat bilobed in middle.

♀.—Similar to the male, but with the abdomen duller, without the special structural features, the apex with a dark reddish sharply pointed pygidial plate; head ordinary, the face and labrum entirely black, but mandibles ferruginous, becoming whitish basally and darkened at apex; scape dark; legs black, the tarsi brownish; first abdominal segment with large black areas.

The mandibles are simple, and the claws dentate in both sexes. The maxillary palpi are six-jointed, the second joint longest; the palpi much more than half the length of the maxillary blade, whereas they are much less than half the length in *P. halictoides* Smith, the type of the genus.



Figures 1 to 10.—Structures of *Perdita* (*Lutziella*) *opuntia*, new species.

1, Mandible of Male. 2, Mandible of Female. 3, Mouth-parts of Male. 4, Second Ventral Abdominal Segment of Male. 5, Sixth Dorsal Abdominal Segment of Male, showing the Spine-like Structures at the end of the Abdomen. 6, Fifth Dorsal Abdominal Segment of Female. 7, Sixth Dorsal Abdominal Segment of Female. 8, Fifth Ventral Abdominal Segment of Female. 9, Sixth Ventral Abdominal Segment of Female. 10, Sting, with Sheath and Sting-palpi.

The labial palpi are four-jointed, the first joint much longer than the other three combined; the third longer than the fourth, and the second than the third.

The male of the Californian *P. macrostoma* Cockerell, by the red abdomen bilobed at apex, resembles *P. opuntiae*, but it has the second ventral segment unmodified, the head and thorax green, and the first recurrent passing beyond the first intercubitus. It also has a supra-clypeal band, lacking in *P. opuntiae*, and distinct dog-ear marks, represented by very small spots in *P. opuntiae*. The stigma of *P. macrostoma* is much larger. The stigma of *P. opuntiae* resembles that of *Macroteropsis lator* (Cockerell), but the marginal cell is not so obliquely truncate, and the maxillary palpi are quite different. The mandibles also are quite different in *Macroteropsis*, being bifid apically. The mandibles and face-markings of male *P. opuntiae* closely resemble those of *P. crassiceps* Cockerell, but that has the abdomen dark brown.

In Annals and Magazine of Natural History, December 1899, p. 414, there is given a table showing the relation between the lengths of the first and remaining joints of the labial palpi in species of *Perdita*. At that time the measurements of *P. halictoides*, the type of *Perdita*, could not be given, but we now know that the first joint is about 544μ , and the other three combined about 224μ , the latter about 41% of the former. In *P. opuntiae* the first joint is about 832μ , the last three together 480μ , the latter about 58% of the former. Thus, in respect to the labial palpi, *P. opuntiae* resembles the species of the subgenus *Perditella*, though it differs in most other respects, the venation, for example, being extremely different. In the Argentine there is a Panurgid, *Camptopoeum opuntiarum* Joergensen, which appears to be oligotropic upon *Opuntia*. It has no resemblance to the Colorado bee.

From the *Opuntia* flowers at White Rocks, June 13, Mrs. Cockerell also took a male *Lithurgus apicalis* Cresson, a female *Agapostemon texanus* Cresson, and a female *Colletes*. There were also specimens of *Epicauta* on the cacti, and a single specimen of *Moneilema*, which I am unable to identify with any of the species indicated by Casey.

EXOMALOPSIS Spinola

PACHYCERAPIS, new subgenus

Male antennæ with the flagellum greatly thickened, the middle portion dentate or serrate beneath; clypeus and labrum of male yellow; three submarginal cells; hind tibiae of male greatly swollen, their tarsi with very long white hair; hind margins of abdominal segments with broad bands of tomentum. The hind femora are quite ordinary, and the hind tarsi are not dentate. The stigma is small and short, and the

marginal cell is not sharply pointed.

Type.—*Exomalopsis* (*Pachycerapis*) *cornigera*, new species.

Related to the genus or subgenus *Anthophorula* Cockerell, but easily known by the peculiar antennæ. The swollen tibiæ and some other characters remind one of *Ancylosceles*, but there is no close affinity. So far as I can determine from the description, *E. serrata* Friese, from Orizaba, Mexico, is also a species of *Pachycerapis*.

***Exomalopsis* (*Pachycerapis*) *cornigera*, new species**

♂.—Length about 5 mm.; black, with the clypeus and labrum yellow (redened by cyanide in type); mandibles ferruginous; face (especially sides), lower part of cheeks, and pleura with white hair; occiput and thoracic dorsum with very pale yellowish-tinted hair; front polished and shining, with a deep median groove; ocelli in a line; scape yellow, long and rather thick; flagellum strongly incrassate, pale orange-yellow, joints 10 to 12 more or less dusky above, middle joints dentiform beneath, apical joint flattened and curved; mesothorax and scutellum shining, with fine punctures; tegulæ dark rufous; wings pale brownish, stigma and nervures dusky reddish; extreme base of wings clear ferruginous; legs black, small joints of tarsi rufescent; all the tibiæ swollen, but the hind ones greatly so; abdomen closely and quite strongly punctured, first segment hairy all over, segments 2 to 5 with broad bands of grayish tomentum; apex with no special armature.

Sabino Basin, Sta. Catalina Mts. Arizona, 32° 22' N., 110° 46.5' W.; about 3800 feet above sea-level; July 8-20, 1916; (Lutz).

Easily known from *E. serrata* Friese, the latter being densely fulvous-haired, with yellowish-white mandibles. There can be little doubt, however, that the two are closely allied. *E. serrata* is larger than *E. cornigera*, being 7 to 8 mm. long.

***Exomalopsis solani* Cockerell**

This is a typical *Exomalopsis*, but its known distribution is greatly extended by the American Museum materials, collected by Dr. Lutz.

Colorado.—1 ♀; Pueblo; August 9, 1920; on a vacant lot in town. This is the first *Exomalopsis*, *sensu stricto*, from Colorado.

Texas.—5 ♀; Marathon, Brewster County; July 1-2, 1916; at *Cassia*.

Arizona.—1 ♀; north side of Kits Peak, Baboquivari Mts., Pima County, 32° N., 111° 36' W.; about 3650 ft. alt.; August 7-9, 1916. 1 unusually small ♀; west side of Santa Rosa Valley, near the Comobabi Mts.; about 3425 ft. alt.; August 9-10, 1916.

In New Mexico, it is known to occur in the Middle Sonoran zone, from Mesilla to Albuquerque.

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NEOTROPICAL ANTS OF THE GENERA *CAREBARA*, *TRANOPELTA* AND *TRANOPELTOIDES*, NEW GENUS¹

BY WILLIAM MORTON WHEELER

Our knowledge of most of the subterranean, or hypogæic myrmicine ants of the American tropics is still very meager. Of the seven genera of the Ethiopian and Indomalayan Regions (*Solenopsis*, *Carebara*, *Pheidologeton*, *Aneleus*, *Oligomyrmex*, *Aëromyrma* and *Liomyrmex*) and the same number of neotropical genera (*Solenopsis*, *Carebara*, *Carebarella*, *Erebomyrma*, *Spelæomyrmex*, *Tranopelta* and *Tranopeltoides*) only two, *Solenopsis* and *Carebara*, are represented in both hemispheres. The South American species of *Allomerus*, which have minute yellow workers and large, dark-colored males and females, and would therefore seem to belong among the genera just mentioned, inhabit the cavities of living plants, as I shall show in another publication, and cannot be regarded as hypogæic. While the genus *Solenopsis* is represented by the greatest number of species in South America, *Carebara* was not known to occur beyond the confines of the Ethiopian and Indomalayan regions till ten years ago, when Santschi described the female and male of a species from French Guiana. The discovery, on my recent trip to British Guiana, of all three phases of a closely allied species and of the workers of the true *Tranopelta gilva* Mayr, together with a study of certain forms which must be referred to a new but closely allied genus, has led me to undertake the following brief revision of the South American species of *Carebara*, *Tranopelta* and *Tranopeltoides*.

CAREBARA Westwood

Carebara bicarinata Santschi

Carebara bicarinata, SANTSCHI, 1912, Bull. Soc. Ent. France, p. 139, 2 figs., ♂ ♀;
WHEELER, 1922, Bull. Amer. Mus. Nat. Hist., XLV, p. 170.

According to Santschi, the female of this species, taken by Le Moult in French Guiana, measures 12–12.8 mm. and is pale brownish yellow, with slightly infuscated wings. The male measures 9.3 mm. and is described as testaceous yellow, with the sides of the mesonotum, and in some cases the terminal gastric segments, more or less reddish

¹Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, No. 210.

brown. The males were found to be variable and Santschi was not sure that they belonged to the same species as the female. He also mentions one male from Goya, Brazil (J. de Gaulle) as measuring 10.5 mm. The uncertainty of the specific identity of his males and females is increased by the occurrence of more than one species of *Carebara* in the Guianas and the Amazon valley.

***Carebara winifredæ*, new species**

WORKER (Fig. 1).—Length, 2.3–2.5 mm.

Head subrectangular, slightly longer than broad, as broad in front as behind, with nearly straight, subparallel sides and slightly concave posterior border. Mandibles rather convex, with somewhat oblique, 4-toothed apical borders. Clypeus longitudinally concave in the middle, bluntly bicarinate, each carina terminating in a blunt tooth on the anterior border; the sides narrow and depressed. Frontal area obsolete; frontal groove short and rather deep; frontal carinae small. Eyes absent. Antennæ 9-jointed; scapes two-thirds as long as the head; first funicular joint twice as long as broad; joints 2–4 nearly twice as broad as long; joints 5 and 6 longer but distinctly transverse; the large two-jointed club much longer than the remainder of the funiculus, the basal joint longer than broad, half as long as the terminal joint. Thorax rather small, the pro- and mesonotum somewhat flattened above, the humeri and sides rounded; the promesonotal suture obsolescent. Mesoëpinotal constriction short and acute; epinotum as long as broad, narrowed behind, in profile rounded and sloping, the declivity abrupt, longitudinally concave in the middle, delicately marginate on each side. Petiole with a short, slender peduncle, the node abrupt, rounded, from above transversely elliptical, fully twice as broad as long. Postpetiole very similar and scarcely broader, but in profile distinctly lower than the petiolar node. Gaster somewhat larger than the head, broadly elliptical, the anterior border concave; first segment forming about two-thirds of its surface. Legs rather short; joints 2–4 of fore and middle tarsi not shorter than long.

Mandibles shining; the remainder of the body only moderately so, the inner borders of the mandibles with several small, sharp punctures. Head, thorax, pedicel and gaster evenly and finely punctate, the punctures on the head more distinct, on the appendages much finer and more superficial.

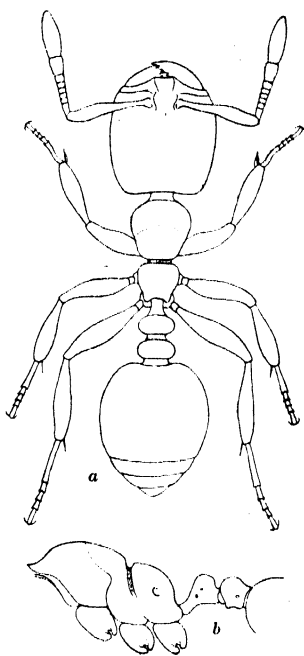


Fig. 1. *Carebara winifredæ*, new species. a, Worker, dorsal view; b, thorax and pedicel of same in profile.

Hairs and pubescence pale yellow, the former short and confined to the clypeus and tip of gaster, the pubescence very short, fine and appressed, arising from the punctures and scarcely more distinct on the body than on the appendages.

Pale yellow; the legs, pedicel and gaster paler and more whitish; mandibles reddish with black teeth. Sides of clypeus and mesoepinotal constriction brownish.

FEMALE.—Length, 10–10.5 mm.; wings, 13.5 mm.

Head, including the eyes, distinctly broader than long, broader behind than in front, with nearly straight posterior border and slightly concave, subparallel cheeks. Eyes moderately convex, half as long as the sides of the head; ocelli large, close together, in subconfluent depressions. Mandibles large, their apical borders broad, 8-toothed, the four basal teeth small and rather indistinct. Clypeus bluntly bicarinate, concave in the middle, the anterior border rounded, somewhat projecting, slightly sinuate in the middle. Frontal groove deep, extending from the pointed, backwardly projecting median portion of the clypeus to the anterior ocellus. Antennæ slender, 10-jointed, the scapes reaching to the posterior orbits; second and third funicular joints a little broader than long, the fourth and fifth as long as broad; the remaining joints longer than broad, the terminal being as long as the two preceding subequal joints together. Thorax rather long and narrow, scarcely as broad as the head through the eyes, the mesonotum one and one-half times as long as broad, convex above, as is also the scutellum, the epinotum short, its base sloping, much shorter than the abrupt declivity which is very feebly concave in the middle and indistinctly marginate on the sides. Petiole similar to that of the worker but with broad, stout peduncle and less convex node; the postpetiole from above more depressed, suberescenscentic, with rather strong posterior border. Gaster large, suboblong, somewhat shorter than the remainder of the body; the first segment forming less than half of its surface, the fourth segment large, blunt and rounded. Legs rather slender. Wings long; radial cell closed.

Smooth and shining; mandibles striate at the base, towards the tips coarsely striatopunctate, the two areas separated by a small, smooth space. Clypeus smooth in the middle, coarsely punctate on the sides. Remainder of body evenly punctate, the punctures sharper on the head, much sparser on the pro- and mesonotum, which are more shining; cheeks, gula, mesopleuræ and epinotum very finely longitudinally striate.

Hairs yellow, very short, present only on the clypeus, gula and tip of gaster; pubescence also very short, appressed and dilute, arising from the punctures.

Pale castaneous; clypeus, mandibles and posterior portion of gaster darker; legs paler, yellowish brown; wing-membranes opaque, fuliginous; veins and pterostigma yellow, with strong black borders.

MALE.—Length, 7–7.5 mm.; wings, 7.5–8 mm.

Head, including the eyes, nearly twice as broad as long, convex behind in the ocellar region. Eyes very large and convex, taking up the whole of the sides of the head; ocelli large and prominent. Mandibles with a large apical tooth and three or four minute basal teeth. Clypeus concave behind and laterally, with a large convex tubercle in the middle, the anterior border rounded and entire. Antennæ 13-jointed; long and filiform; scapes somewhat compressed, shorter but stouter than the second funicular joint; first funicular joint a little longer than broad; remaining joints cylindrical, subequal, except the second and last, which are longer than the others. Thorax similar to that of the female, but shorter; petiole also similar, but the node less elevated and concave in the middle; postpetiole campanulate, broader than the petiole. Gaster elongate elliptical. Legs slender.

Subopaque; gaster and mesonotum more shining; head more opaque, especially behind, where it is sharply reticulate-rugulose. Mandibles opaque, punctate. Mesonotum and scutellum distinctly, pleuræ very indistinctly, gaster finely and superficially punctate.

Pilosity and pubescence much as in the female, but the pubescence longer on the upper surface of the gaster.

Pale brownish yellow; legs clearer yellow; posterior half of head black; mesonotum with a long anteromedian and two long lateral, dark brown stripes; anterior half of head, wing-insertions and metanotum brown; wings colored as in the female; but the dark borders of the veins narrower.

Described from numerous workers, four females and six males, which were brought to me in a living condition August 5, 1920, by Mr. Alfred Emerson, who took them from the depths of a large termitarium of *Syntermes dirus* Klug, under the roots of a huge moro tree on the left bank of the Oyuni River, near Kartabo, British Guiana. The species is dedicated to Mrs. Winifred J. Emerson. It is evidently very close to *bicarinata*, but both the male and female are smaller and the coloration of the body and wings of the female is much darker. Perhaps *winifredæ* is merely a subspecies of Santschi's species, but the latter may prove to be based on the sexual phases of *C. anophthalma* (*vide infra*).

The finding of *C. winifredæ* in the nest of *Syntermes dirus*, which Mr. Emerson informs me is, of all South American termites, the most like the African species now referred to the genus *Termes* (*sensu stricto*) and hence like the species with which the African carebaras live, is of unusual interest in connection with the zoögeographical hypothesis of a former land-connection between Africa and South America. It is certain, however, that the termites once had a much wider range than at present, since we find them in the Miocene of Florissant, Colorado, and in the Baltic amber of Lower Oligocene age. It is not improbable, therefore, that the genus *Carebara* may also have had a circumpolar distribution in the northern hemisphere during the early and middle Tertiary. Hence we are not compelled to regard the occurrence of *C. winifredæ* with *Syntermes dirus* as proof positive of the former existence of von Ihering's "Archihelenis" or of similar constructions.

Carebara anophthalma (Emery)

Oligomyrmex anophthalmus EMERY, 1905, Bull. Soc. Ent. Ital., XXXVII, p. 138, note, ♀.

Carebara anophthalma WHEELER, 1922, Bull. Amer. Mus. Nat. Hist., XLV, p. 170, ♀.

WORKER.—Uniformly pale yellow, shining, with moderately dense, pubigerous punctuation; the short pubescence apparently adherent, and there are no erect hairs, probably owing to the defective preservation of the specimen (for I feel cer-

tain that there should be a few small hairs, at least on the clypeus). Head a little longer than broad, broader behind, feebly concave at the posterior border. Mandibles with 4 teeth. Clypeus strongly elevated in the middle, but edentate. Frontal carinae very short. No traces of eyes. Antennae short and thick; 9-jointed; the scape only slightly surpassing the middle of the length of the head; second joint as long as the three following; joints 3-7 transverse; the two last forming a club, the last joint as long as the whole remainder of the funiculus, less its basal joint. Thorax feebly impressed between the mesonotum and epinotum; the latter curvilinear in profile. Nodes of petiole and postpetiole transversely oval, as broad as the epinotum. Legs short and robust; joints 2-5 of the fore and middle tarsi broader than long. Length, 1.6 mm.

Ega, on the Amazon; a single specimen from the collection of F. Smith, with the label "new genus, 9 joints in antenna." (Emery)

In all probability the specimen was taken by H. W. Bates.

As this description applies rather closely to the worker of *C. winifredæ*, described above, I sent Professor Emery specimens of the latter to compare with the type of *anopthalma*. He wrote me that they are specifically distinct and kindly sent camera lucida sketches of the head, thorax and pedicel of the Brazilian species. The head of this species is somewhat longer, more narrowed anteriorly; the epinotum is decidedly smaller and proportionally much shorter, and the postpetiolar node is broader in comparison with the petiolar node. As already suggested, this species may be the worker of the form described by Santschi as *C. bicarinata*.

Carebara mayri (Forel)

Tranopelta mayri FOREL, 1901, Mitth. Naturhist. Mus. Hamburg, XVIII, p. 61, ♂.
Carebara mayri SANTSCHI, 1912, Bull. Soc. Ent. France, p. 140, ♂.

According to Santschi, this species, described by Forel as a *Tranopelta*, from a specimen taken by Captain Jermann in Paraguay, is a *Carebara*. Forel's description is very brief, but von Brunn, who compared the venation of the type in the Hamburg Museum with that of the male *C. bicarinata* sent him by Santschi, found it to be the same in both species. Forel gives the length of *mayri* as 9 mm. I refer to this species a single male measuring 8.5 mm. and taken by Dr. Roman at Apipica on the Rio Autaz, Brazil (Royal Museum of Stockholm). It differs from the male of *winifredæ* in its larger size and in the following characters: the body is more brownish yellow; the median dark brown stripe on the mesonotum is lacking; the wings are much paler; the scapes of the antennae are more swollen and more convex anteriorly; the node of the petiole is not impressed in the middle and the pubescence on the thorax and antennae is longer, denser and more conspicuous.

TRANOPELTA Mayr***Tranopelta gilva* Mayr**

Tranopelta gilva MAYR, 1866, Sitzb. Akad. Wiss. Wien, LIII, p. 514, ♀ ♂; EMERY, 1890, Bull. Soc. Ent. Ital., XXII, p. 53, ♂; DALLA TORRE, 1893 'Cat. Hymen.', VII, p. 74, ♀ ♂; FOREL, 1899-1900, 'Biol. Centr. Amer.', 'Hymen.', p. 79, ♀ ♂; FOREL, 1912, Mém. Soc. Ent. Belg., XX, p. 3, ♀ ♂; EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀ ♂; WHEELER, 1922, Amer. Mus. Novitates, No. 45, p. 8, ♀ ♂.

WORKER (undescribed, Fig. 2).—

Length, 2.3-3.2 mm.

Very feebly polymorphic. Head sub-rectangular, as broad as long, very slightly narrower in front than behind, with straight sides and concave posterior border. Eyes minute, reduced to about 8-12 facets, situated at the middle of the sides of the head. Mandibles moderately large and convex, their apical borders oblique, with four subequal teeth, or sometimes five in small individuals. Clypeus rather convex in the middle, without carinae, its anterior border rounded and entire. Frontal carinae small; frontal area and frontal groove absent. Antennae 11-jointed, rather slender, the scapes extending a little beyond the middle of the head in large, proportionally longer in smaller individuals; first funicular joint fully as long as the three succeeding joints together, second joint nearly as long as broad; joints 3-7 distinctly broader than long; the last three joints forming a club, which is longer than the remainder of the funiculus; the two basal joints longer than broad and together a little shorter than the enlarged terminal joint. Thorax rather small, much broader through the pronotum than through the epinotum; promesonotal suture extremely faint or obsolete, the dorsal surface of the pro- and mesonotum,

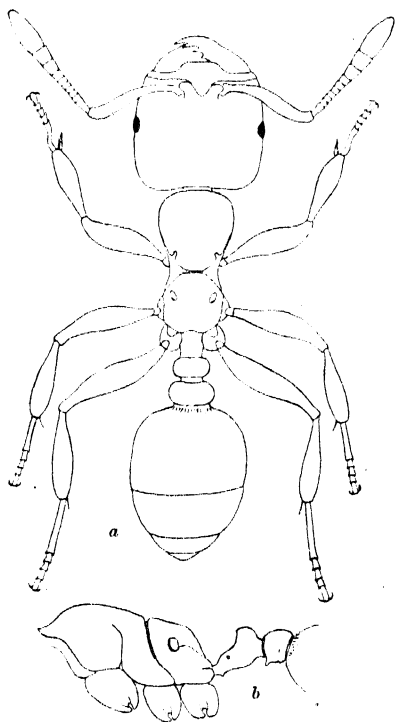


Fig. 2. *Tranopelta gilva* Mayr. a, Worker of the typical form of the species, dorsal view; b, thorax and petiole of same in profile.

flattened, nearly straight in profile; the mesonotum narrowed behind to the short, acute and not very deep mesoepinotal constriction. Epinotum from above a little longer than broad, slightly concave in the middle; in profile with the base and declivity subequal and meeting at a very obtuse angle; the former continuing the dorsal outline of the pro- and mesonotum. Epinotal stigmata large and circular. Petiole with a very distinct peduncle, which is swollen at the stigmata; the node abrupt, somewhat scale-like, with rather sharp anterior border above, its anterior surface

flattened, its posterior surface more convex, from above transversely elliptical, about twice as broad as long; the ventral surface convex in the middle, anteriorly with a small, acute, downwardly directed tooth. Postpetiole rounded, lower than the petiolar node and slightly broader, about one and one-half times as broad as long, its anteroventral border in profile acute and tooth-like. Gaster broadly elliptical, somewhat flattened dorsoventrally, the first segment forming about half its surface. Legs slender and moderately long; joints 2-4 of the fore tarsi broader than long.

Smooth and shining; mandibles striatopunctate; body sparsely punctate, the punctures on the head sharper and more conspicuous; neck, mesopleuræ and sides of epinotum subopaque and very finely striate; peduncle of petiole finely reticulate-rugulose.

Hairs pale yellow, rather abundant, erect, coarse and uneven on the body; shorter, denser and more reclinate on the appendages. The hairs on the vertex, thorax and pedicel longer than elsewhere. Pubescence undeveloped, except on the gula and sides of the head, where it is long and subappressed.

Yellow; legs and gaster paler, more whitish; mandibles reddish, their teeth, the anterior border of the clypeus and the articulations of the funicular joints dark brown.

The gynetypes and androtypes of this species were from Venezuela (C. A. Dohrn), and males and females have been recorded also from Colombia; Pará, Brazil (Goeldi); Alajuela and Juan Viñas, Costa Rica (A. Alfaro); and the Volcan de Chiriqui, Panama (Champion). I have seen specimens from Port of Spain, Trinidad (Aug. Busck), Belem, near Pará, Brazil (W. A. Schulz), Lassance, Minas Geraes, Brazil (J. C. Bradley), Bartica, British Guiana (Wm. Beebe), Barakara and Kartabo, British Guiana (Wheeler). The males and females are common at lights and the foregoing records are undoubtedly from such specimens. The description of the worker is drawn from specimens from two colonies containing also many females and males. One colony was taken at Kartabo, August 3, 1920, while Mr. Alfred Emerson and I were excavating a large colony comprising more than 500 workers of the formidable stinging ponerine, *Paraponera clavata* Fabr. The *Tranopelta* were occupying small chambers one to one and one-half feet below the surface of the soil and communicating with the galleries of the *Paraponera*. In this case the smaller species was evidently behaving as a thief-ant. On August 1 I found the stomach of a four-toed ant-eater (*Tamandua tetradactyla*) to contain no less than 14 species of ants, a large proportion of which consisted of hundreds of workers and dozens of males and winged females of *Tranopelta gilva*. The ant-eater must have unearthed and devoured a very flourishing colony of this ant. July 15 I found at Barakara, on the right bank of the Mazaruni River, a large colony of *gilva*, comprising hundreds of workers but no sexual forms, under the bark of a living tree. On the surface of the wood the

ants were attending numerous snow-white coccids which have been recently described by Mr. Harold Morrison as *Ripersia subcorticis*. There is nothing to indicate that *T. gilva* occurs with termites. Mr. Alfred Emerson, who has carefully studied the termites of British Guiana and has conscientiously preserved all the ants and other organisms which he has found with them, has never taken *T. gilva* in or near the nests. It would seem, therefore, that this ant sometimes leads an independent life and that when it behaves as a thief-ant prefers to associate with other Formicidæ.

***Tranopelta gilva* variety *amblyops* (Emery)**

Monomorium amblyops EMERY, 1894, Bull. Soc. Ent. Ital., XXVI, p. 148, ♀; FOREL, 1911, Deutsch. Ent. Zeitschr., p. 299, ♀.

Tranopelta gilva var. *brunnea* FOREL, 1909, Deutsch. Ent. Zeitschr., p. 259, ♀ ♂ ♀.

Tranopelta gilva var. *brunnea* FOREL, 1909, Deutsch. Ent. Zeitschr., p. 259, ♀ ♀ ♂.

Tranopelta amblyops EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀ ♀ ♂.

According to Emery, Forel's *T. gilva* var. *brunnea*, originally described from San Bernardino, Paraguay (K. Fiebrig), is a synonym of his *Monomorium amblyops*, described from Matto Grosso, Brazil. An examination of male, female and worker cotypes of Forel's form, and a female and several males recently taken by Dr. J. C. Bradley at Lassance, Minas Geraes, Brazil, shows that they represent merely a variety of *gilva*. The worker and male are very close to the corresponding phases of the typical form. In the worker *amblyops* the eyes are perhaps a trifle smaller, the antennæ somewhat shorter, the median funicular joints slightly more transverse. In the male the body, and especially the head and thorax, are of a more brownish-yellow color. In the female the surface of the body is decidedly more shining and much less densely pubescent, the mandibles, head, thorax and pedicel are of a castaneous-brown color, much darker than in the typical *gilva*; the wings are also darker, and the ventral surface of the petiole is not provided with an acute, downwardly directed spine. This spine is apt to be absent also in the male.

***Tranopelta gilva* variety *albida* (Mann)**

Tranopelta gilva var. *albida* MANN, 1916, Bull. Mus. Comp. Zool., LX, p. 446, ♀.

?*Tranopelta gilva* EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀.

My cotypes of this form, taken by Dr. Mann on the Madeira-Mamoré R. R., in Matto Grosso, Brazil, show that it is a distinct variety, as he maintained, and not the worker of the typical *gilva*. The specimens are smaller (1.5–2 mm.) and decidedly paler, being whitish; the antennal scapes are a little longer, the anterior border of the petiolar node is a little more acute, and the eyes are even smaller than in the var. *amblyops*.

Tranopelta heyeri, (Forel)

Monomorium heyeri FOREL, 1901, Ann. Soc. Ent. Belg., XLV, p. 389, ♀.

Tranopelta heyeri FOREL, 1913, Bull. Soc. Vaud. Sc. Nat., (5) XLIX, p. 17, ♀;
EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀.

A dimorphic species, the major worker resembling a *Pheidole*, but grading into the minor forms.

WORKER MAJOR.—Length, 4–4.2 mm. Mandibles thick, smooth, shining, with scattered punctures, a few striae towards the tips and about four teeth. Clypeus slightly convex, without teeth or carinae, but feebly notched in the middle of its anterior border, slightly impressed behind the notch and slightly or scarcely convex in the middle portion, which presents a suggestion of the two carinae seen in the other species. Head large, square, as broad as long, slightly narrowed anteriorly, feebly concave behind, resembling that of a soldier *Pheidole*, with a feeble but rather distinct occipital furrow, disappearing on the vertex. Frontal area triangular. A median pit on the front of the vertex in place of the anterior ocellus. The eyes, situated a little in front of the middle of the sides of the head, are very small and flat, composed of about a dozen partly atrophied facets. Antennae short; 11-jointed; club of three joints, about as long as the rest of the funiculus, thick, with the last joint at least as long as the two preceding united; the other joints, except the first, broader than long. Frontal carinae short; frontal groove short and indistinct. Promesonotal suture almost obsolete; pronotum large, robust, almost shouldered. Mesoepinotal suture deeply impressed, but without a constriction properly so-called, forming only a short interruption in the thoracic dorsum, which is feebly convex and scarcely higher in front than at the basal face of the epinotum. The latter is slightly longer than the declivity into which it passes insensibly, with two feeble longitudinal swellings, separated by a concavity or shallow longitudinal groove. Petiolar node pedunculate anteriorly and abruptly surmounted behind by a large, scale-shaped node with straight superior border, lower and broader than in (*Monomorium*) *lataslei*, less thickened and broader than in *amblyops*. Pestpetiolar node transverse, more or less rectangular but rounded and narrower at the anterior corners, much broader than long. Legs rather short.

Smooth and very shining, with scattered, fine, often brownish, piligerous punctures. Antennal fossae, frontal carinae and sides of clypeus longitudinally and somewhat obliquely striated. Sides of mesonotum reticulate-punctate and more or less opaque.

An erect, yellowish, rather fine pilosity is everywhere rather uniformly distributed, somewhat oblique on the tibiae and antennae, where it is shorter and a little more abundant. Pubescence almost absent.

Entirely pale yellow; even the abdomen very pale. Mandibles and sides of clypeus reddish. Articulations of appendages slightly infuscated.

WORKER MINOR.—Length, 2.7–2.9 mm. Like the major, but the head, though large, square and at least as broad as long, is much smaller, without occipital furrow and scarcely concave behind. The clypeus, though not bicarinate, has nevertheless indications of the two carinae of the genus (*Monomorium*). Eyes with only 4 to 6 facets. Petiolar node slightly thicker and narrower. In other respects like the worker major, but the sides of the mesonotum are subopaque, more feebly reticulate and the color is even paler.

A single worker media is intermediate (3.3 mm.).

St. Leopoldo, Rio Grande do Sul, Brazil, living only with termites, where it was discovered by Mr. Heyer. Received from Mr. Wasmann. (Forel)

The species is also recorded by Forel from São Paulo, Brazil, where it was taken by von Ihering.

***Tranopelta heyeri* variety *columbica* (Forel)**

Tranopelta heyeri var. *columbica* FOREL, 1912, Mém. Soc. Ent. Belg., XX, p. 3, ♀.

?*Tranopelta gilva* EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀.

This form is doubtful. It may be the same as the one later described by Mann as *T. gilva* var. *albida* or it may be, as Emery suggests, the minor worker of the typical *gilva*. The following is Forel's description.

WORKER.—Length, 1.6–2.6 mm. Even paler than the type of the species and much smaller; white, scarcely yellowish. In other respects very similar, but the posterior portion of the clypeus between the frontal carinæ is narrower, very much as in *gilva* var. *brunnea* Forel. The largest worker has a proportionally much smaller head than in the type of *heyeri*, but perhaps I failed to find the worker maxima. In other respects like the type of the species; eyes with 4 to 6 facets.

Dibulla, in the ground, at the bottom of the nest of *Mycocepurus smithii* Forel, and San Antonio, in a subterranean nest, beneath dried cow-dung, Sierra Nevada de Santa Marta, Colombia.

***Tranopelta subterranea* (Mann)**

Monomorium (Milara) subterraneum MANN, 1916, Bull. Mus. Comp. Zool., LX, p. 444, Pl. IV, figs. 29, 30, ♀.

Tranopelta subterranea EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀.

I agree with Emery, that this species, taken by Dr. Mann on the Madeira-Mamoré R. R. in Matto Grosso, Brazil, is a *Tranopelta*, but it certainly differs from the other species in several important particulars. The clypeal margin is sinuate in the middle, the mandibles are 6-toothed, the legs and antennæ are long, the mesoëpinotal constriction is very pronounced, the first segment of the gaster forms nearly its whole surface and the color is reddish testaceous instead of pale yellow. There is considerable difference in the size of the body (3.5–5 mm.) and especially of the head. Dr. Mann found the specimens about three feet below the surface of the soil.

TRANOPELTOIDES, new genus

The female ant described by Forel as *Tranopelta huberi* seems to me to belong to an undescribed genus for which I would suggest the name *Tranopeltoides*. It differs from the female *Tranopelta* in possessing spines on the epinotum, thus indicating an even higher development of these structures in the worker. Moreover, I have found two males that

appear to belong to the same genus. They have very short, 11-jointed antennæ, with very short scape and globular first funicular joint. Very probably, therefore, all three phases of the species which I refer to this genus have 11-jointed antennæ, instead of the antennæ being 11-jointed only in the worker and female and 13-jointed in the male as in *Tranopelta*. The veins in the hind wing of the female, and especially of the male, are few and feebly developed as compared with *Carebara*, *Tranopelta*, etc. The following species is to be regarded as the type of the genus.

***Tranopeltoides huberi* (Forel)**

Tranopelta huberi FOREL, 1907, Mitth. Naturhist. Mus. Hamburg, XXIV, p. 5, ♀.
? *Tranopelta subterranea* EMERY, 1919, Bull. Soc. Ent. France, p. 61, ♀.

FEMALE.—Length, about 8–8.5 mm. Mandibles smooth, coarsely punctate. Anterior border of clypeus transverse, broadly sinuous on each side, in the middle scarcely broadly impressed or very feebly concave. Clypeus much less convex than in *gilva*, not carinate. Head transversely rectangular, very broad, nearly one-quarter broader than long, straight posteriorly, somewhat broader than anteriorly, with feebly convex sides. The antennal scapes distinctly surpass the posterior border of the head. All the funicular joints of the 11-jointed antennæ are longer than broad; club precisely as in *gilva*. The mesonotum overarches the pronotum anteriorly. Epinotum with two broad, stout, triangular, rather blunt spines, somewhat more than half as long as the straight declivity, which is about three times as long as the base of the spines. Declivity almost vertical. Anterior slope of petiolar node gently rising anteroposteriorly in the form of a gradual inclined plane, broad behind, with convex sides, longer than broad, posteriorly with two blunt, tooth-like corners. The posterior and at the same time superior border of this flattened segment is almost acute and broadly emarginate between the corners. Thence the surface is short and steep. Postpetiole rounded, somewhat broader than long. The gaster is lacking in the single specimen. Legs rather long and slender; tarsal claws well developed.

Clypeus, cheeks and sides of head as far as the frontal carinae densely striate and lustrous. Front between the carinae, vertex, occiput, thorax and petiole smooth, shining and sparsely punctate. Only the epinotum is irregularly rugulose.

Erect pilosity uneven, partly long, sparse, pointed, somewhat oblique on the tibiae, arising from punctures. Appressed pubescence very dilute.

Sordid yellow, in places somewhat brownish yellow; legs paler; antennæ yellowish brown. Mesonotum with three brown longitudinal bands. Ocelli enclosed in a brownish spot. Wings brownish, smoky, with brown veins and stigma; venation precisely as in *gilva* Mayr.

Surinam, Upper Pará (J. Michaelis).

Notwithstanding the great differences, I regard this species as a *Tranopelta*, though it is very distinct from *gilva* Mayr and evidently also from the much larger *mayri* Forel, known only from the male, and is particularly aberrant in its long antennal joints, the epinotal spines and small stature. I dedicate this species to Dr. Huber, director of the Museum Goeldi at Pará, the author of excellent observations on the habits of ants. (Forel)

***Tranopeltoides parvispina*, new species**

FEMALE (Fig. 3d).—Length probably somewhat more than 10 mm., but post-petiole and gaster lacking; length of wings 13 mm.

Head trapezoidal, about one-fifth broader than long, broader behind than in front, with straight posterior and lateral borders. Eyes at the middle of the sides and about one-third their length. Ocelli large, in deep impressions. Mandibles moderately convex, their apical margins with five subequal, rather blunt teeth. Clypeus flattened, its anterior border straight and entire in the middle, sinuate on each side. Frontal area triangular; frontal groove distinct only in the middle of a line connecting the frontal area and the anterior ocellus. Antennæ rather short,

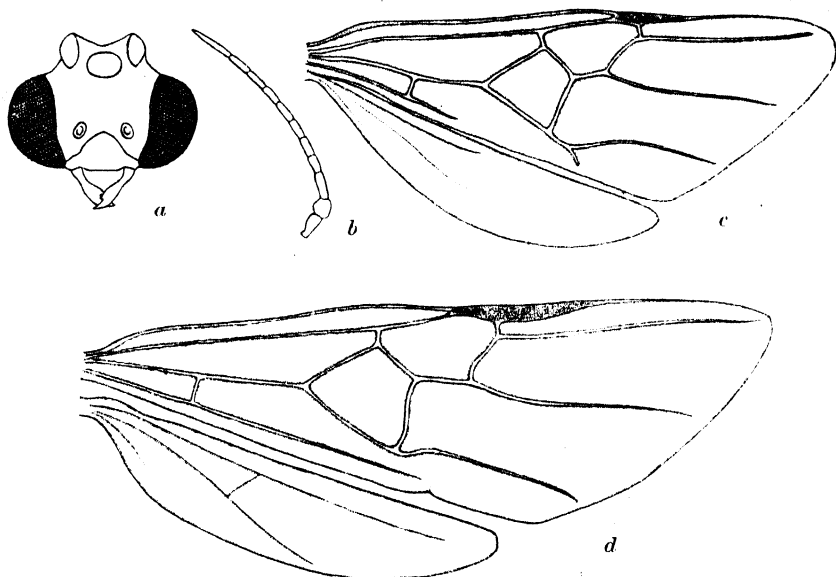


Fig. 3. a, *Tranopeltoides bolivianus*, new species, head of male; b, antenna of same; c, wings of same; d, *Tranopeltoides parvispina*, new species, wings of female.

11-jointed, the scapes reaching only to the posterior third of the lateral borders of the head; first funicular joint as long as the three succeeding joints together; joints 2-7 scarcely longer than broad; 8 and 9 a little longer than broad; the terminal as long as the two preceding joints together. Thorax elongate-elliptical, narrower than the head, mesonotum much longer than broad, convex anteriorly where it overarches the pronotum. Epinotum small and short, abruptly sloping, the base very short, scarcely distinct from the flattened declivity, above and at the sides of which there is a pair of small, blunt, triangular, flattened teeth, not longer than broad at their bases and the latter not more than a quarter the length of the declivity; episternal angles very small. Petiole less than twice as long as high; the anterior slope of the node in the form of an inclined plane, the node itself very short, broadly excised in

the middle and with each corner forming an acute angle. The ventral surface bears a small triangular, downwardly directed tooth at the anterior end. Legs moderately long and stout. Venation of wings essentially as in *Tranopelta* but the radial cell is more nearly closed, the cubital cell is shorter and the discoidal cell is larger.

Shining; mandibles striatopunctate; clypeus smooth in the middle, coarsely punctate on the sides. Head above finely, longitudinally striate and with rather coarse, scattered, piligerous punctures. Thorax very smooth and shining above, sparsely and finely punctate; epinotum subopaque, the lower pleuræ very finely and longitudinally, the declivity transversely striate.

Hairs yellow, erect, rather uneven, sparse, longer on the head than on the thorax; suberect and nearly as long on the tibiae as on the thorax; mesosternum and femora with dilute, appressed, yellowish pubescence.

Yellowish brown; head darker, more reddish brown; legs slightly paler; mesonotum with three indistinct, darker longitudinal streaks; mandibular teeth blackish. Wings distinctly yellowish, the veins and stigma brownish yellow.

A single specimen taken August 8, 1911, at Kaieteur, British Guiana, by Dr. F. E. Lutz.

This species is certainly congeneric with the preceding and is distinct in its larger size and in having much shorter antennal scapes, a different sculpture of the head and mandibles and smaller spines on the epinotum.

***Tranopeltoides bolivianus*, new species**

MALE (Fig. 3 a, b, c).—Length, 5.5 mm.

Head, including the eyes, broader than long; both the eyes and ocelli very large, larger than in *Tranopelta*, the latter on an elevated projection. Cheeks absent. Mandibles small, with two acute teeth, the basal minute. Clypeus moderately convex, with straight, entire anterior border. Antennæ slender, very short, 11-jointed; the scape scarcely twice as long as broad, the first funicular joint subglobular, a little broader than long, second joint longer than the scape, remaining joints, except the last, somewhat shorter, terminal joint tapering. Thorax from above broadly elliptical, broader than the head, the mesonotum without Mayrian furrows, convex anteriorly and overarching the pronotum. Epinotum with subequal base and declivity, meeting on each side at a small but distinct angle which represents the spine of the female. Mesosterna very convex. Petiole unarmed beneath; the node lower, much rounder and not angulate at the posterior corners. Postpetiole somewhat broader than the petiole, nearly as long as broad, campanulate. Gaster shaped much as in *Tranopelta* but the broad, outermost genitalic appendages are more truncated and the pygidium is less acutely pointed. Legs long and slender, tarsal claws large. Wings conspicuously broad, their venation like that of the preceding species.

Smooth and shining, with small, indistinct and scattered, piligerous punctures; mandibles with a few coarse punctures.

Hairs yellowish, rather long, sparse, suberect, covering the body and legs but absent on the flexor surfaces of the tibiae and tarsi, most conspicuous on the gaster. Legs and antennæ also covered with fine whitish pubescence.

Yellowish brown, antennæ and legs paler yellow; space between the ocelli jet black; mandibular teeth and two longitudinal streaks on the mesonotum dark brown. Wings brownish hyaline with yellow veins and stigma.

A single specimen taken by Prof. Nils Holmgren at San Firmin, Bolivia, and loaned by the Royal Museum of Stockholm.

I believe there can be little doubt that this male is congeneric with the two preceding species, of one of which it may represent the missing sex. Another male in my collection seems to be distinct and may be given the following name.

***Tranopeltoides peruvianus*, new species**

MALE.—Length, 5 mm.

Closely resembling the preceding species but honey-yellow, except the black area between the ocelli and the two dark brown streaks on the mesonotum. The wings are also paler, with pale yellow veins and stigma. The angles of the epinotum are obsolete, the petiole and postpetiole are shorter and their nodes more depressed above. The greatest difference, however, lies in the length of the antennal joints, the third to sixth funicular being distinctly shorter than in the Bolivian species and the second funicular distinctly swollen at the base. The eyes are somewhat less convex and the cheeks, though extremely short, are nevertheless perceptible. The long hairs are lacking on the extensor surfaces of the hind tibiæ and there are only a few of them on the fore and middle tibiæ. The oblique or subappressed pubescence on the antennæ, and especially on the legs, is distinctly longer.

A single male from Callanga, Peru, purchased many years ago from Staudinger and Bang-Haas. The terminal joints of both antennæ are missing. This male, too, may perhaps belong to one of the females described above.

AMERICAN MUSEUM NOVITATES

Number 49

October 23, 1922

56.9,61

DIBELODON EDENSIS (FRICK) OF SOUTHERN CALIFORNIA, *MIOMASTODON* OF THE MIDDLE MIOCENE, NEW GENUS¹

BY HENRY FAIRFIELD OSBORN

During the years 1916-1917, Mr. Childs Frick (1921, p. 279)² conducted field work in southern California as part of Professor John C. Merriam's comprehensive plan for the study of the geologic and faunal history of the Pacific coast. In the rich "Eden beds" were discovered proboscidean remains which the author (*op. cit.*, p. 405) determined as follows:

Trilophodon (*Tetrabelodon*) *shepardi edensis*, n. subsp. *Type specimen*.—The portion of a skull and posterior maxillaries, containing the last molar of the left side and a section of that of the right side, Univ. Calif. Coll. Vert. Pal. no. 23501 (fig. 160); two associated molars from the left and the right side respectively, Univ. Calif. Coll. Vert. Pal. 23503, 23504 (figs. 164, 162); and portions of premaxilla and tusks, Univ. Calif. Coll. Vert. Pal. no. 24047 (pl. 50), all from Univ. Calif. loc. 3269.

The Eden beds are correlated with the Snake Creek of Nebraska, the Rattlesnake of Oregon, the Thousand Creek of Nevada, and the Middle Etchegoin of California, namely, of Middle Pliocene age. Excavation in the Eden beds continued by Mr. Frick resulted in the recovery of the complete upper tusks of one of the cotype specimens which were figured by the author (*op. cit.*, Pl. 50): "Figs. 1 and 2. Portions of premaxillary and tusks of Eden type specimen, no. 24047, $\times \frac{1}{4}$." Under Mr. Frick's direction these cotype tusks have been carefully restored and mounted, as represented in the present article (Fig. 1). Mr. Frick has kindly offered this precious cotype to the present writer for redescription together with newly discovered grinding teeth found in the same ledge of the Eden beds, representing several individuals which probably belong to the same species. This new cotype and the associated material prove that the Eden proboscidean is very close indeed in all its characters to the classic *Mastodon andium* Cuvier of the valley of Tarija, Bolivia, and especially to the skull described by Nordenskiöld³ in 1903.

¹This is the eighth in the author's list of special papers on the evolution and classification of the Proboscidea since 1918, and the eighteenth in his total list of papers on this subject since 1907.

²Frick, Childs, 'Extinct Vertebrate Faunas of the Badlands of Bautista Creek and San Timoteo Cañon, Southern California,' Univ. Calif. Publ. Bull. Dept. Geol., XII, No. 5, pp. 277-424, Pls. XLIII-L, 165 text figures. December 28, 1921.

³Nordenskiöld, Erland, 1903, 'Über die Säugetierfossilien des Tarijats, Südamerika. I. *Mastodon Andium* Cuv.,' Kungl. Svenska Vetensk.-Akad. Hand., Bd., 37, No. 4, pp. 1-30, Taf. i-vi.

The matter of chief interest and importance is that these notorostriine proboscideans migrated along the western coast of North America EN ROUTE to their habitat in the Andes. The generic name to be applied to this animal is not *Trilophodon* Falconer but *Dibelodon* Cope. Cope (1884)¹ founded *Dibelodon* on three species, namely, *Dibelodon (Mastodon) shepardi* Leidy, *Dibelodon tropicus* Cope, and *Mastodon humboldtii* Cuvier, the first being specified as type. Consequently, *Trilophodon (Tetralodon) shepardi edensis* Frick = *Dibelodon edensis* (Frick).

***Dibelodon edensis* (Frick)**

CHARACTERS.—As shown in Fig. 1, *A*₁, *A*₂, *B*, the premaxillæ, the anterior portion of the palate, the dentition, and the enamel areas of the tusks are so similar to those of the Tarija skull referred to *M. andium* by Nordenskiöld, that if the Eden cotype had been found at Tarija it would without question have been referred to the species *Dibelodon andium*. The enamel ribbon in both the Eden and the Tarija specimens leaves the skull on the OUTER border of the tusk which by an inward rotation on its own axis carries the enamel (*e e e*) to the INNER border; in both photographic figures the enamel borders are artificially indicated with a faint white line. The *Dibelodon edensis* cotype is a male individual, consequently the tusks are more robust; it is a younger individual, hence the tusks are relatively shorter and the twisting of the enamel band does not extend quite so far. It appears probable that *Dibelodon edensis* is less progressive than *Dibelodon andium* in its tusk formation.

The teeth included by Mr. Frick as type and cotype specimens are the following:

Posterior maxillæ with left M³ and right M³, Univ. Calif. 23501 (fig. 160).

Associated molars right M² and left M², Univ. Calif. 23503, 23504 (figs. 164, 162).

Portions of premaxilla and tusks, Univ. Calif. 24047.

These types give the ridge formula M 2³, M 3⁴.

New specimens in the American Museum collection from the same Eden ledge referred to *Dibelodon edensis* are the following: A. 18219, left M³; B. 18219, jaw with left M₂₋₃; C. 18219, palate with well-worn right M²⁻³; D. 18219, right M³; E. 18219, right M³; F. 18219, maxillary with right M²⁻³ (frag.); 18218, left DM³⁻⁴, M¹; 18217, left M₃; B. 18216, juvenile inferior maxillary with DI₂, DM₂₋₄, M₁. The latter specimen contains a small tusk apparently enamelled.

These referred specimens belong to several different individuals and the determination of the superior and inferior grinding teeth is provisional. The lower jaw with milk incisor (B. 18216) is of great interest if it proves to present us with the juvenile characters of the *Dibelodon edensis* jaw, as appears probable.

¹Cope, E. D., 1884, 'The Extinct Mammalia of the Valley of Mexico,' Proc. Amer. Phil. Soc., XXII, pp. 1-21.

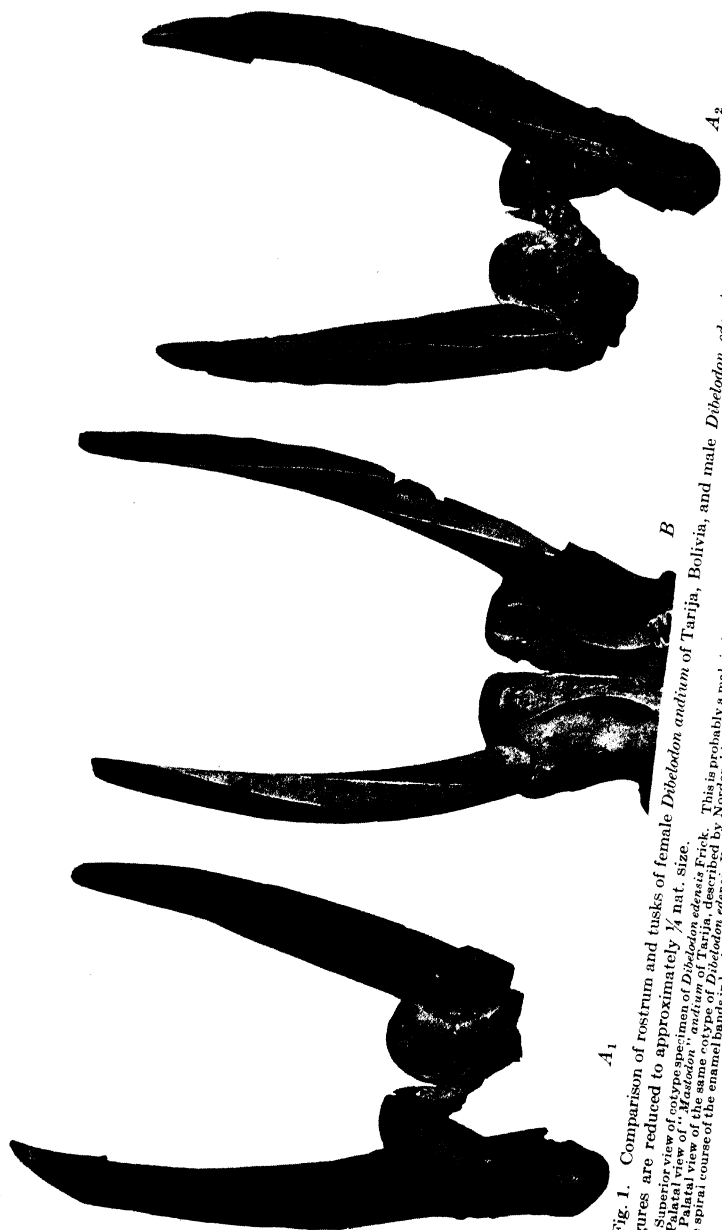


Fig. 1. Comparison of rostrum and tusks of female *Dibelodon andium* of Tarija, Bolivia, and male *Dibelodon edensis* of southern California. All figures are reduced to approximately $\frac{1}{2}$ nat. size.

A₁. Superior view of cotype specimen of *Dibelodon andium* of Tarija, Bolivia. This is probably a male individual. (Fig. 2) as a female individual.

A₂. Superior view of cotype specimen of *Dibelodon edensis* of southern California. This is probably a male individual. (Fig. 2) as a female individual.

B. Palatal view of the same cotype of *Dibelodon edensis* as in A₂, showing the spiral course of the enamel bands in both specimens may be observed in all the figures.

Miomastodon, new genus

GENOTYPIC SPECIES.—*Mastodon merriami* Osborn, 1921,¹ from the Virgin Valley formation, Middle Miocene of Nevada.

GENERIC CHARACTERS.—A member of the true Mastodontinæ phylum leading into the *Mastodon americanus* type, distinguished from the true *Palæomastodon beadnelli* of the Lower Oligocene of the Fayûm, Egypt, by rounded, greatly enlarged, upcurved superior tusks; form of inferior tusks not certainly known, probably rounded and more or less encased in enamel; distinguished from the true Pleistocene *Mastodon americanus* by the presence of a broad enamel band extending from the base to the summit of the tusk. Ridge formula: $M\ 2\ \frac{3}{8}$, $M\ 3\ \frac{3\frac{1}{2}}{4}$, as compared with the *Palæomastodon beadnelli* ridge formula: $M\ 2\ \frac{2\frac{1}{2}}{3}$, $M\ 3\ \frac{2\frac{1}{2}}{3}$; as compared with the *Mastodon americanus* ridge formula: $M\ 2\ \frac{3}{8}$, $M\ 3\ \frac{4}{15}$.

To this genus may at present be referred four species, namely: Genotypic species, *Mastodon merriami*, Middle Miocene, Nevada = *Miomastodon merriami*

Mastodon proavus Cope, 1873, late Middle Miocene, Pawnee Creek, Colorado = *Miomastodon proavus*

Mastodon matthewi Osborn, 1921, Middle Pliocene, western Nebraska = *Miomastodon matthewi*

Also probably *Mastodon tapiroides americanus* Schlesinger, Lower Pliocene of Hungary = *Miomastodon tapiroides americanus*.

The distinctive grinding tooth characters in all these Mastodontinæ are: (1) that each loph (protoloph, metaloph, *et seq.*) is composed of a main internal and external bunoid cone; (2) the intermediate conule region does not develop; (3) the earliest grinder is tetrabunodont; (4) as the third loph is added it becomes hexabunodont; (5) as the fourth loph is added it becomes octobunodont; (6) whereas these four, six, and eight cones heighten (hypsodonty), they never unite transversely into a crest; thus none of the Mastodontinæ becomes zygolophodont.

The broad enamel band of the tusks is apparently placed on the CONCAVE surface of the tusk in *Miomastodon merriami*, on the CONVEX surface of the tusk in *Miomastodon tapiroides americanus*.

The occurrence of *Miomastodon merriami* in the Virgin Valley, Nevada, in Middle Miocene time demonstrates that these true mastodons arrived in this country much earlier than we have hitherto supposed. It is probable that the so-called "*Mastodon*" *proavus* of Cope from the Middle Miocene of Pawnee Creek, Colorado, is another representative of the genus *Miomastodon*; on the other hand, "*Mastodon*" *brevidens* Cope, 1889, from the late Middle Miocene, from the Deep River beds of Montana, probably belongs to the genus *Rhynchotherium*, distinguished by short molar teeth (hence *R. brevidens*) and internal lobes bearing trefoils on crests one and two.

¹Osborn, H. F., 'First Appearance of the True Mastodon in America,' Amer. Mus. Novitates, No. 10, June 15, 1921, pp. 1-6, Figs. 1 and 2.

AMERICAN MUSEUM NOVITATES

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59.7, 58°C (96.9)

CARANGOIDES JORDANI FROM THE HAWAIIAN ISLANDS WITH NOTES ON RELATED FISHES

BY JOHN TREADWELL NICHOLS

In the summer of 1921, Dr. David Starr Jordan, of Stanford University, made a collection of fishes in the Hawaiian Islands, the locality where I had had the pleasure of first meeting him twenty years previous. A series of this material was to come to The American Museum of Natural History. As I had been making an especial study of the subfamily Caranginae, all the carangids were courteously sent here to be worked up. The following notes are placed on record as a contribution to a knowledge of certain of these forms and of the Hawaiian fish fauna.

Decapterus maruadsi (Temminck and Schlegel)

The collection contains two specimens (300 and 305 mm. in length to base of caudal) of this species, previously known from Japan and China coasts. They are at once recognizable as distinct from *Decapterus macarellus pinnulatus*, the common form in Hawaiian waters, by greater depth, longer pectoral, and greater development of scutes. It is not surprising that *Decapterus maruadsi* is common to the western and central Pacific, for the other Pacific species of *Decapterus* is also found in Japan, though there provisionally recognized as a distinct race, *muroadsi*. We have no Japanese *maruadsi* material available for comparison with these Hawaiian specimens. The larger (305 mm.) specimen has the following measurements:

Depth in length to base of caudal, 4.5 (in length to notch of caudal, 4.7); head, 3.9; eye in head, 3.5; snout, 3.0; maxillary (which barely reaches front of eye), 3.0; pectoral (which is pointed), 1.2; thickness of body, 1.8. Teeth are minute but evident. Dorsal has about 34 soft rays; anal 28. The straight part of the lateral line is contained 1.5 in the arc of the low curve. The scutes are traceable forward for almost the entire length of the straight part of the lateral line, and number about 36. A conspicuous black spot at the angle of the opercle.

Caranx affinis lundini (Jordan and Seale)

Caranx affinis Jordan and Evermann, 1905, 'Fishes Hawaiian Islands.'

Decapterus lundini Jordan and Seale, 1906, 'Fishes of Samoa.'

Six specimens 130 to 200 mm. standard length (to base of caudal) have been compared with two, 179 to 182 mm., from Somaliland (Barnum Brown, Collector). These latter, which presumably are true *C. affinis* Rüppell, with type from the Red Sea, have appreciably smaller teeth, forming a broader band, where they cease to be uniserial in the front of the jaw, have more pointed heads, and are less compressed, thus agreeing with the figure and description of *affinis* in Day, 1889, 'Fauna British India,' Fishes. The Hawaiian fish, however, is exceedingly close to *affinis* if specifically distinct.

***Caranx cheilio* (Snyder)**

One 400 mm. long to base of caudal has been compared with a smaller (270 mm.) specimen of *C. guara* from Bermuda. The two species are close, a slightly shorter dorsal in *cheilio* (24 versus 26 soft dorsal rays) the most obvious technical distinction. *Cheilio* has back more elevated, profile steeper, ventral outline more horizontal, lips thicker, eye nearer snout instead of in the center of head.

***Carangoides jordani*, new species**

Carangoides ferdau Jordan and Evermann, 1905, 'Fishes of Hawaiian Islands,' p. 198, fig. 77. Not *Scomber ferdau* Forskal.

The type, No. 8104, American Museum of Natural History, Hawaiian Islands, 1921, D. S. Jordan, is 200 mm. long to base of caudal. Villiform teeth on palate and in bands on jaws; arch of lateral line low, its arc 1.1 in straight part; scutes small, restricted to posterior portion of straight part, about 30.

Depth, 2.4 in length; head, 3.5. Eye, 4.4 in head; maxillary, 2.4; dorsal lobe, 1.0; anal lobe, 1.5; pectoral, 1.0. Maxillary to under front of orbit, not reaching pupil. Gill-rakers 23 on lower limb of first arch. Height of anterior lobe of soft dorsal 1.4 in base of that fin (not following curve of back), 1.3 in depth of body. Dorsal soft rays 30, anal 27. Chest before the ventrals scaleless, the naked area widening as it reaches gill-covers. Color in alcohol bluish plumbeous, paler below, fins dark gray, darkest on dorsal and anal lobes.

Two specimens, 200 mm. in length to base of caudal, are identical with *Carangoides ferdau* Jordan and Evermann, which differs from *ferdau* of Forskal in the larger number of fin rays (dorsal soft rays 29 to 30, anal 25 to 27), and differs from *C. gymnostethoides evermanni* in the character of the lobe of the soft dorsal which ends in a slender filament and is contained 1.4 to 1.6 times in the base of that fin, 1.3 to 1.4 in depth of body. It is more slender than *Carangoides gilberti*, with differently shaped body and fins.

Carangoides gymnostethoides evermanni Nichols

A specimen referred to this form is somewhat larger (330 versus 313 mm. to base of caudal) than the type, with which it has been compared (see 1921, American Museum Novitates, No. 3). It agrees closely with same in most respects, and differs from it in being less compressed, thickness 1.7 versus 2.0 in head. The dorsal lobe is shorter 1.5 versus 1.4 in head, 2.5 versus 2.0 in base of fin; maxillary just reaches front of pupil; and the naked area on chest broadens more anteriorly, where it meets the gill-covers.

This individual is not differentiable from *orthogrammus* by higher dorsal lobe, but is less slender than the description of that fish, depth 2.7 versus $3\frac{2}{3}$.

Alectis ciliaris (Bloch)

One, $19\frac{1}{4}$ inches long to base of caudal, is the largest that the writer has ever had the pleasure of examining. A table of the variations of this species with size will be found on page 287, XLII, Bulletin, American Museum of Natural History (J. T. Nichols, 1920). The following measurements of this large individual (which has one of two dorsal filaments extending to beyond caudal, an anal filament to caudal base, and lacks dark cross-bands) carry on, in a manner to be expected, the proportional changes with growth indicated by smaller material. Thus depth in length is 2.1; eye in head 3.8; snout 2.8; pectoral 0.8; ventral 2.1. The curve of the lateral line in straight part, 1.0, does not show the anticipated change; but the most surprising condition is found in the gill-rakers, 17 in number, but the most anterior, and also the only one well on the upper limb of the arch, rudimentary, as though they might be dropped out in still further growth. If gill-rakers are dropped out by growth, *Alectis ciliaris* might easily become *Alectis hopkinsi* in reaching 26 inches, the size of the unique type of that species (*loc. cit.*, p. 291).

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Number 51

November 21, 1922

56.9, 61

REVISION OF *PALÆOMASTODON* AND *MÆRITHERIUM*.

PALÆOMASTODON INTERMEDIUS, AND *PHIOMIA* *OSBORNI*, NEW SPECIES

BY H. MATSUMOTO

This communication is a preliminary abstract of results reached in the author's researches during the year 1921 on the American Museum collections of *Palæomastodon*, *Phiomia*, and *Mærittherium*, in comparison with the type collections in the British Museum which were described by Charles W. Andrews between 1901 and 1906. The abstract was prepared from Dr. H. Matsumoto's MS. by Dr. Charles C. Mook, August, 1922. The full paper will appear in the American Museum Bulletin.

1.—*PALÆOMASTODON*, *PHIOMIA*

The genus *Palæomastodon* should be subdivided into two genera as follows:

- A. Palate wide in proportion to the length of cheek teeth series. Symphysis rather short, its posterior end lying at a considerable distance anterior to the anteriormost cheek tooth (P_3); the most conspicuous one of the anterior mental foramina lying just below the anteriormost cheek tooth, as well as a considerable distance behind the posterior end of the symphysis.

$$\text{Ridge formula: } Dm \frac{???}{???}, P \frac{1.1.2}{1+.2}, M \frac{2+ 2+ 2+}{2+ 2+ 2-3+}$$

Last premolars and all molars bunolophodont, appearing like typically lophodont teeth when moderately worn; no trefoil pattern of cusps

= *PALÆOMASTODON* Andrews.

Genotype: *Palæomastodon beadnelli* Andrews, 1901.

- B. Palate long and narrow. Symphysis long, its posterior end lying only a little anterior to or posterior to the anterior end of the anteriormost cheek tooth (P_3); the most conspicuous one of the anterior mental foramina lying far anterior to the anteriormost cheek tooth, as well as to the posterior end of the symphysis.

$$\text{Ridge formula: } Dm \frac{1.2.3}{1.2.3}, P \frac{1.1-1+.2}{1+.2}, M \frac{3.3.2+-3}{3.3.3-3+}$$

Last premolars and all molars typically bunodont; trefoil pattern of cusps well developed..... = *PHIOMIA* Andrews.

Genotype: *Phiomia serridens* Andrews and Beadnell, 1902.

***Palæomastodon parvus* Andrews, 1905**

Andrews, 1905, Geol. Mag., Dec. V, N. S., II, pp. 562, 563.

Type fig.: Andrews, 1906, 'Descr. Cat. Tertiary Vertebrata of Fayûm, Egypt,' p. 163, fig. 55.

American Museum specimens: No. 13497 from Fluvio-marine formation.

***Palæomastodon intermedius*, new species**

Type: American Museum No. 14547; fragment of left mandibular ramus, bearing all three molars *in situ*, with parts of alveoli of penultimate and last premolars.

Paratype: American Museum No. 13480; a fragment of left mandibular ramus bearing last molar and posterior root of penultimate molar *in situ*.

American Museum referred specimens: Nos. 13449, 14548.

All from Fluvio-marine formation.

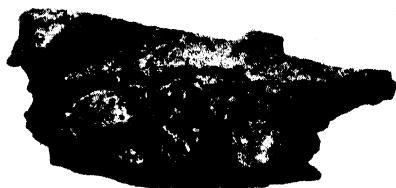


Fig. 1. Type specimen of *Palæomastodon intermedius*, new species Matsumoto. Amer. Mus. No. 14547, Fayûm Collection. Slightly over one-fourth natural size

The palate of paratype specimen of *Palæomastodon intermedius*, No. 13499, measures as follows:

Length from the frontal plane tangential to the anterior limits of the crowns of the two P ² to the tip of the posteriorly directed process at the posterior limit of the median suture between the two palatines.....	250 mm.
Distance between the two P ²	53 mm.
Distance between the two M ¹	77 mm.
Distance between the two M ²	75 mm.

All the upper molars are distinctly bilophodont, as a generic character; the rudiment of the third ridge being much feeble and much less conspicuous than that of the lower molars. The mode of wearing corresponds well to what is stated of the lower molars. Besides, all the generic characters of all the cheek teeth of this species are the same as those stated in the diagnosis of the genus.



Am Mus No. 13480

Fig. 2. Paratype specimen of *Palæomastodon intermedius*, new species. Amer. Mus. No. 13480, Fayûm Collection. Slightly over one-third natural size.

***Palæomastodon beadnelli* Andrews, 1901**

Andrews, 1901, Tagebl. d. V. Intern. Zool. Congress, Berlin, No. 6, p. 4.

Type fig.: Andrews, 1901, Geol. Mag., Dec. IV, N. S., VIII, text fig. 1, A, B, p. 401.

American Museum referred specimen: No. 13481.

***Phiomia (minus) minor* Andrews, 1904**

(*Palæomastodon beadnelli* Andrews, 1901; *Pal. barroisi* Pontier, 1907.)

Andrews, 1904, Geol. Mag., Dec. V, N. S., I, p. 115.

Type fig.: 1906, Pl. xiv, figs. 1, 1A, text fig. 50D.

American Museum referred specimens: Nos. 13469, 13471, 13475, 13483, 13486, 13448, 13455, 13461, 13464, 13465, 13467.

***Phiomia wintoni* Andrews, 1905**

(*Phiomia serridens* Andrews and Beadnell, 1902; *Palæomastodon beadnelli* Andrews, 1901; *Pal. wintoni* Andrews, 1905; *Pal. barroisi* Pontier, 1907.)

Andrews, 1905, Geol. Mag., Dec. V, N. S., II, p. 563.

"The paratype (Andrews' fig. 3) of *Phiomia serridens* is merely a hyracoid, as subsequently referred to by Andrews himself."

Type fig.: Andrews, 1906, p. 157, fig. 53.

American Museum referred specimens: Nos. 13470, 13474, 13476, 13477, 13484, 13485, 13494, 13450, 13451, 13452, 13453, 13454, 13456, 13457, 13458, 13459, 13460, 13479, 13482, 13488, 13489, 13491, 13492, 13493, 13327, 13463, 13466.

***Phiomia osborni*, new species**

Type: American Museum No. 13468; a nearly complete mandible, bearing all the teeth *in situ*.

Type fig.: Fig. 3 of this paper.



Fig. 3. Type specimen of *Phiomia osborni*, new species. Amer. Mus. No. 13468, Fayûm Collection. One-fifth natural size.

This species, *Phiomia osborni*, appears to be more progressive than *Phiomia minor* and *Phiomia wintoni* in the better developed posterior ridge of the first and second lower molars and in the better developed posterior talon of the last lower molar; and to be more archetypal than the same in the more gradual increase in size posteriorly of the lower cheek teeth.

II.—MÆRITHERIUM

(Genotype: *Mæritherium lyonsi* Andrews, 1901)

Andrews distinguishes three species of *Mæritherium*:

M. lyonsi Andrews, 1901. Large form from Qasr-el-Sagha. Matsumoto does not specify a type but gives dimensions of Andrews' specimen, Geol. Mag., Dec. IV, N. S., VIII, pp. 403-405, fig. 2, p. 403. Some of the dimensions are estimated from Andrews' figures.

M. gracile Andrews, 1902. Small form from Qasr-el-Sagha formation. (Geol. Mag., Dec. IV, N. S., IX, p. 292.)

Type fig.: Andrews, 1906, Pl. xvii, figs. 1, 2.

M. (trigodon) trigonodon Andrews, 1904. Small form from Fluvio-marine formation. (Geol. Mag., Dec. V, N. S., I, p. 112.)

Type fig.: Andrews, 1906, Pl. ix, fig. 5.

Schlosser divided Andrews' *M. lyonsi* into *M. lyonsi*, restricted, large form from the Qasr-el-Sagha formation, and *M. andrewsi*, large form from the Fluvio-marine formation.

He considered the small forms to be based upon sexual characters only. Matsumoto considers that the name *M. trigodon* has precedence of *M. andrewsi*.

Matsumoto identifies in the American Museum material:

1. Large form from Qasr-el-Sagha formation, part of No. 13444.

Mæritherium lyonsi Andrews, 1901.

2. Small form from Qasr-el-Sagha formation, No. 13443, part of 13444, 13445, 13446. *Mæritherium gracile* Andrews, 1902.

3. Large form from Fluvio-marine formation.

Type fig.: Andrews, 1906, Pls. VIII, IX. Specimens provisionally referred to *M. lyonsi*.

American Museum Nos. 13432, 13437.

Mæritherium andrewsi Schlosser, 1911.

4. Small form from the Fluvio-marine formation, Nos. 13430, 13431, 13433, 13435, 13436, 13439. (Andrews, 1904, Geol. Mag., Dec. V, N. S., I, p. 112.)

NOTE BY HENRY FAIRFIELD OSBORN, August, 1922.—(1) The significance of the above revision is that the true *Palæomastodon beadnelli* has bilophodont intermediate molars and a relatively broad skull; it is a rare animal both in the British Museum and American Museum collections; according to Andrews (1922) the genotype (*Palæomastodon beadnelli*) was found at the very base of the Fluvio-marine Beds, Lower Oligocene, 50 or 100 feet BELOW the *Phiomia* level. The original type specimen was destroyed in the Custom House at Cairo, but the type is fortunately now represented by the British Museum cast. Associated with the type is a very large femur and humerus.

(2) *Phiomia*.—The various specimens of *Phiomia* were found 50 or 100 feet ABOVE the type level of *Palæomastodon beadnelli*; the genotype (*Phiomia serridens*) is a very immature specimen close in size to the type of *Phiomia minor* which may be a synonym; the genotype is validated by an immature milk tooth specimen of a slightly larger animal. *Phiomia* is a very long-jawed animal, with trilophodont intermediate molars, whereas *Palæomastodon* is a relatively short-jawed animal, with bilophodont intermediate molars.

(3) Matsumoto's revision of these genera conforms to Andrews' observations of 1905, p. 562: "The species of *Palæomastodon* fall into two sections, in one of which the posterior end of the symphysis of the mandible is situated considerably in front of the level of the anterior premolar, while in the other it is only very little in front of that point. The first group, moreover, is distinguished by the comparative simplicity of the molars, in which the accessory cusps are scarcely at all developed, and by the small size of the talon of the last lower molar; into this subdivision the original species, *P. beadnelli*, falls, together with a much smaller form for which the name *P. parvus* is now proposed. The type-specimen of this new species is the right ramus of the mandible, with the premolars and molars *in situ*, though somewhat crushed."

Dr. Andrews has also kindly reviewed the matter (letter July, 1922), and while he does not specifically confirm Matsumoto's revision, he does not offer to dissent from it.

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55.2,6(77.4)

AÉROLITE FROM ROSE CITY, MICHIGAN

BY EDMUND OTIS HOVEY

At about eleven o'clock in the evening of October 17, 1921, a meteor was seen to pass through the sky from N.N.W. to S.S.E. over the northeastern portion of the Lower Peninsula of Michigan. Near Rose City, Ogemaw County, it exploded with the usual accompaniment of several loud reports, and three of the fragments into which it burst have been recovered on the premises of Mr. George Hall about nine miles northeast of this little hamlet, which gives its name to the fall. These portions are stated to have weighed about $3\frac{1}{4}$ pounds (1.47 kg.), 7 pounds (3.18 kg.), and 14 pounds (6.36 kg.) when obtained. They are now the property of Mr. P. W. A. Fitzsimmons of Detroit, Michigan, to whom I am indebted for the opportunity of describing the largest mass. The weight was not checked up on receipt of the specimen, but after sectioning and removal of a fragment for chemical analysis the material weighs twelve pounds (5443 gm.) and it is supposed that the original weight of this mass was not more than about twelve pounds ten ounces (5726 gm.).

The fragment in hand is roughly ovoid in shape and is about 225 mm. by 167 mm. by 136 mm. in dimensions. The color of the exterior is black and that of the interior as shown in section is also black. A side view is given in Fig. 1 and an end view in Fig. 2. On all sides the surface is deeply pitted. The skin due to superficial melting while passing through the earth's atmosphere is well developed but does not possess a brilliant luster. This skin extends into the pits or depressions but is less in evidence or is wanting on the knobs which also characterize the exterior of the mass. These knobs are the protruding parts of small masses, like the pebbles in a conglomerate, which are cemented together to form the main mass. The fragment here described is reported to have fallen about forty feet south of Mr. Hall's house and to have buried itself about two feet in soft, sod-covered earth. It was found the day after it fell. When first examined by the writer, many of the pits in its surface contained grass, grass roots, and soil firmly wedged into them. The grass was not burned or even charred, and therefore it is evident that the temperature of the mass when it struck the ground was not elevated.

The second largest piece (3.18 kg.) was found later in the same day about 150 feet from the house, near a highway and not so deeply imbedded in the ground as the previous mass.

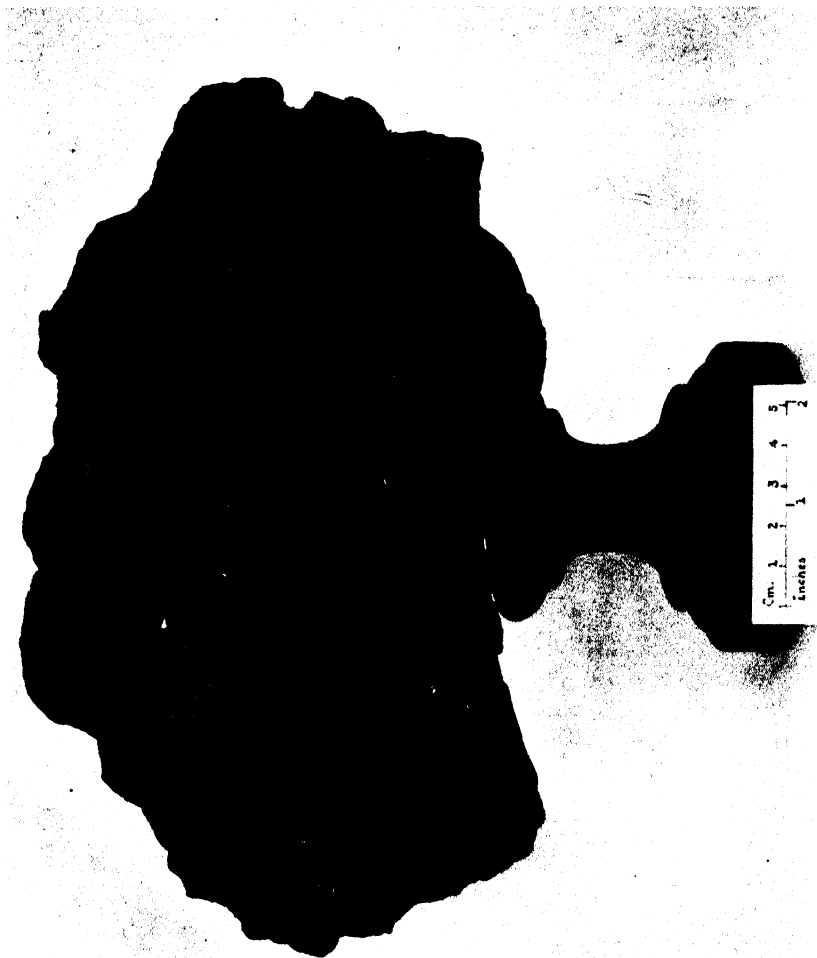


Fig. 1. Rose City, Michigan, Aérolite
Side view, showing agglomerative character of the fragment and deep pitting due to melting along zones of cementation.

The appearance of a longitudinal section of the largest mass, the one studied, is shown in Fig. 3. Small particles of nickel-iron are numerous and are scattered uniformly through the areas which are cross sec-



Fig. 2. Rose City, Michigan, Aërolite
End view.

tions of the surface knobs. Many of these particles are triangular or approximately triangular in outline, as shown in the section. Others are spongy and irregular. All enmesh portions of the silicate groundmass. The metal is likewise concentrated in long stringers between these



Fig. 3. Rose City, Michigan, Aërolite

Section lengthwise of the mass, showing agglomerative structure, the zones of dense cementing material and the distribution of the particles of iron.

areas or along portions of the knobs, and many of the stringers are approximately parallel in position. These stringers or larger areas of iron are porous or spongy in texture and contain silicate groundmass within them. Treatment with 5% nitric acid was negative as to the production of Widmanstätten figures, but the iron, by the triangular outline of many of its particles and by their linear arrangement, suggests the presence of octahedral crystalline structure.

The agglomeratic character of the mass which is suggested by its external appearance is still more evident in the section. The somewhat rounded secondary masses are cemented together by finer-grained, denser meteoritic material which seems to be lacking in metallic particles. This material does not seem to be glassy in character. In many places the junction line between secondary masses and matrix is accentuated by stringers of iron. These stringers, of course, are the edges of areas of metal partly covering the surfaces of the secondary masses. In one instance at least the dense cementing material is seen entirely surrounded by iron. This area is shown near the left-hand point in Figure 3. In the section, crevices are seen to have developed in several places along the edges of the secondary rounded masses, showing that these are zones of weakness. Examination of the exterior shows that the pitting caused by surface melting during the passage of the meteorite through the earth's atmosphere has gone most deeply into the zones of cementing material or matrix. This shows that this matrix is more fusible, or at any rate less resistant to fusion, than are the large pebble-shaped bodies or knobs which I have called the secondary masses. These zones of matrix seem to have been the lines along which the rupture of the main meteorite took place. One of these lines of near rupture is shown in Figure 3.

The large pebble-shaped knobs or secondary masses which make up the major portion of the meteorite present numerous angular cavities ranging from 0.1 mm. or less to 0.5 mm. or more in diameter. These seem not to be oriented in position, but in places they are aggregated together so that the rock is somewhat porous in texture. They correspond to the miarolitic cavities occurring in some terrestrial rocks and they are bordered by or have projecting into them minute crystals of iron and silicates. The silicate crystals are apparently enstatite or olivine. Some larger irregular cavities also occur. One cavity oval in outline and 5 mm. in length was observed. One end of this cavity is in dense iron which, with the cavity, forms a pear-shaped area 9 mm. long and 5 mm. in greatest width. This appears in Figure 3.

Under the microscope the major part of the silicate portion of the meteorite is seen to be composed of enstatite and olivine, the former predominating. Both of these minerals are light in color, indicating a low content of iron. The olivine is in grains with rounded outlines and also in subcrystalline development. It is much fractured. The enstatite is very slightly pleochroic. The mass does not appear to be chondritic in structure, but here and there the enstatite occurs in small subspherical aggregates with excentric radial structure. One such aggregate is 1.5 mm. by 2 mm. in diameter. Another shows the laths of enstatite arranged in parallel position. The thin section shows an abundance of minute particles of opaque black matter (chromite?) scattered through it. Some of these are without apparent orientation, others are arranged in dendritic growths associated with the enstatite, and still others are grouped in parallel position in the grains of olivine. Minute nodules of troilite, which are easily recognized by their brassy luster, occur.

There are also irregular areas of a substance of very low relief that would be classed as glass, except that it seems to possess a very slight birefringence.

The presence of anorthite is indicated by the chemical analysis, but the mineral has not been recognized under the microscope.

The chemical analysis was made by Mr. J. Edward Whitfield of Philadelphia, on a fragment weighing about forty-five grams, from one of the knobs which seemed to show a good average distribution of metallic iron but no large areas of the metal. Mr. Whitfield's report is as follows:

Separation was made by use of an electro magnet which gave the mineral portion free from metal, but the metallic particles held back mineral that had to be subsequently separated.

Mineral.....	82.75%
Metal.....	17.25

The metallic composition is:—

Iron.....	90.510%
Phosphorus.....	0.245
Sulphur.....	0.275
Nickel.....	8.570
Cobalt.....	0.400

There were no indications of troilite or schreibersite in the clean metal.

The mineral portion has the following composition:—

Silica.....	SiO ₂	43.71%
Alumina.....	Al ₂ O ₃	3.44
Chromium Oxide.....	Cr ₂ O ₃	0.61
Phosphoric Acid.....	P ₂ O ₅	0.25
Ferrous Oxide.....	FeO	15.09
Ferric Oxide.....	Fe ₂ O ₃	None
Calcium Oxide.....	CaO	3.14
Magnesium Oxide.....	MgO	26.97
Manganous Oxide.....	MnO	0.36
Nickel Oxide.....	NiO	0.57
Cobalt Oxide.....	CoO	0.08
Soda.....	Na ₂ O	1.13
Potash.....	K ₂ O	0.18
Sulphuric Anhydride.....	SO ₃	0.68
Ferrous Sulphide.....	FeS	3.88

100.09%

Search was made for oldhamite and lawrencite with negative results. The ferrous sulphide (troilite) was all found with the mineral portion, as the electric current through the magnet was kept low.

The original composition of the meteorite, therefore, would be:

Silicates.....	78.87%
Metal.....	17.25
Troilite.....	3.88

Specific gravity, taken on the finely pulverized material, 3.694.

56.9,88H

NOTES ON THE TYPE OF *HESPEROPITHECUS HAROLD-COOKII* OSBORN

BY WILLIAM K. GREGORY AND MILO HELLMAN

Through the courtesy of Professor Osborn, who has recently described¹ the type of *Hesperopithecus haroldcookii*, we have had the opportunity of making further studies upon this already famous specimen, the results of which are submitted below.

ANALYSIS OF CHARACTERS OF THE TYPE

A careful consideration of the characters afforded by the badly eroded and worn type, an upper molar, leads us to distribute them under the following categories.

I.—CHARACTERS DUE TO LONG EXPOSURE TO WEATHERING, EROSION AND STREAM OR WIND ACTION

- (a) Extreme rounding of all angles margins, ridges, and projections of crown and roots.
- (b) Breaking off of postero-external (disto-buccal) root and smoothing of site of root.
- (c) Loss of enamel on entire external and half of posterior surface.
- (d) Presence of numerous large and small cracks and fissures and rounding of the margins of the cracks, causing them to simulate the natural fissures between cusps.

II.—CHARACTERS DUE TO EXTREME NATURAL WEAR OF THE CROWN

- (a) Extreme shortness or apparent brachyodonty of crown and loss of all main cusps.
- (b) Close apparent approximation of hypocone to protocone.
- (c) Evenly concave wearing surface.
- (d) Deposition of secondary dentine on roof of pulp cavity, beneath wearing surface.
- (e) Diminished size of root canals.

III.—CHIEF DIAGNOSTIC CHARACTERS OF *Hesperopithecus* TYPE

- (a) Upper molar crown conforming to the general type that is common to the anthropoids and man.
- (b) Evenly concave masticating surface, as in *Pithecanthropus*, certain chimpanzees¹ and Australian aborigines.

¹Osborn, Henry Fairfield, 1922, '*Hesperopithecus*, the First Anthropoid Primate Found in America,' American Museum Novitates, No. 37. 5 pp., 3 figs. (reprinted without figures in Science, LV, pp. 463-465, May 3, 1922).

²Fide G. S. Miller, *in litteris*.

- (c) Very large divergent roots, a primitive character retained in the gorilla, in *Pithecanthropus*, and in certain human teeth.
- (d) Transverse diameter of antero-external root smaller than in human molars.
- (e) Floor of pulp-cavity raised well above bifurcation of roots, as in man (Fig. 5).
- (f) Form of floor of pulp-cavity resembling that of anthropoids and man.

REMARKS ON FIGURES 1 TO 4

FIGURE 1

The crown of the *Hesperopithecus* molar was worn down by use nearly to the base, so that the cusps had entirely disappeared. After death the tooth was badly cracked, battered and waterworn. The cracks and rounded edges are due to these processes.

The upper row of figures shows that the occlusal surface of the *Hesperopithecus* molar is more or less intermediate in contour between m^3 and m^2 of the chimpanzee.

In the middle row the rounding of the antero-buccal edge of the crown is probably due to extreme wear and subsequent erosion; so also the bluntness of the root ends. The enamel on the lingual surface, unlike that of the chimpanzee here figured, is not reflected toward the root along the neck of the tooth. The lingual root (1) was extremely robust.

In the lower row we see the site of the postero-external (disto-buccal) root, which has been broken off, and the site subsequently smoothed down by erosion.

FIGURE 2

In *Hesperopithecus* the antero-external (mesio-buccal) root is very large. The site of the missing postero-external root is also shown, as well as the buccal aspect of the lingual root. The deep fissures and cracks are probably due to erosion.

In the middle and lower rows the great width of the lingual root in *Hesperopithecus* is well shown. The lower row shows the site of the missing postero-external root and the deep groove on the buccal side of the lingual root. The great antero-posterior width of the lingual root, as well as the extreme wear of the occlusal surface, indicates that the tooth is an m^2 or m^1 rather than an m^3 .

FIGURE 3

The evenly concave wearing surface of the *Hesperopithecus* molar is seen to resemble that of *Pithecanthropus*.¹ In the upper row we note the

¹Dr. Miller informs us that he finds nearly the same condition in certain chimpanzees, and we find it also in a gorilla and in Australian aborigines and American Indians.

far greater antero-posterior diameter in *Pithecanthropus*, which has a very large hypocone.

The righthand figures in the upper and middle rows represent the second upper molar of an American Indian, which has been artificially ground down to near the base of the crown. The appearance of this tooth indicates that the rounding of the edges in *Hesperopithecus* may be due to erosion, since similar erosional features have been produced experimentally in the modern tooth. Secondly, it shows the rapid lessening of the antero-posterior diameter of the inner or lingual side of the tooth near the base of the crown.

The middle row shows the doubling of the antero-external (mesio-buccal) root in *Pithecanthropus* and the extreme divergence of its inner and outer roots. In *Hesperopithecus* the lingual root is much wider transversely than that in the human molar and the antero-external root is narrower. The lack of a sharp reflection of the enamel toward the lingual side is seen also in the human molars here figured.

The lower row shows well the even concavity of the wearing surface in *Hesperopithecus* and *Pithecanthropus*. The divergence of the lingual and buccal roots is greater than that in the human molar figured.

FIGURE 4

In the upper row we see the doubling of the antero-external root in *Pithecanthropus*, this root being single in *Hesperopithecus* and in the human tooth here figured. The grooving of the lingual root in *Hesperopithecus* is well shown, also the markedly asymmetrical contour of the crown as seen from above. This view especially, together with Fig. 2, lower row, affords evidence that the type specimen of *Hesperopithecus* is an upper molar of a member of the anthropoid-man group.

In the middle row considerable resemblance to the second upper molar of *Pithecanthropus* and to the first upper molar of an American Indian is shown.

In the lower row the Indian molar (m^2), which had been artificially ground down to near the base of the crown, is compared with the unground but worn second molar of the opposite side. Compare Fig. 3, upper row, with remarks above.

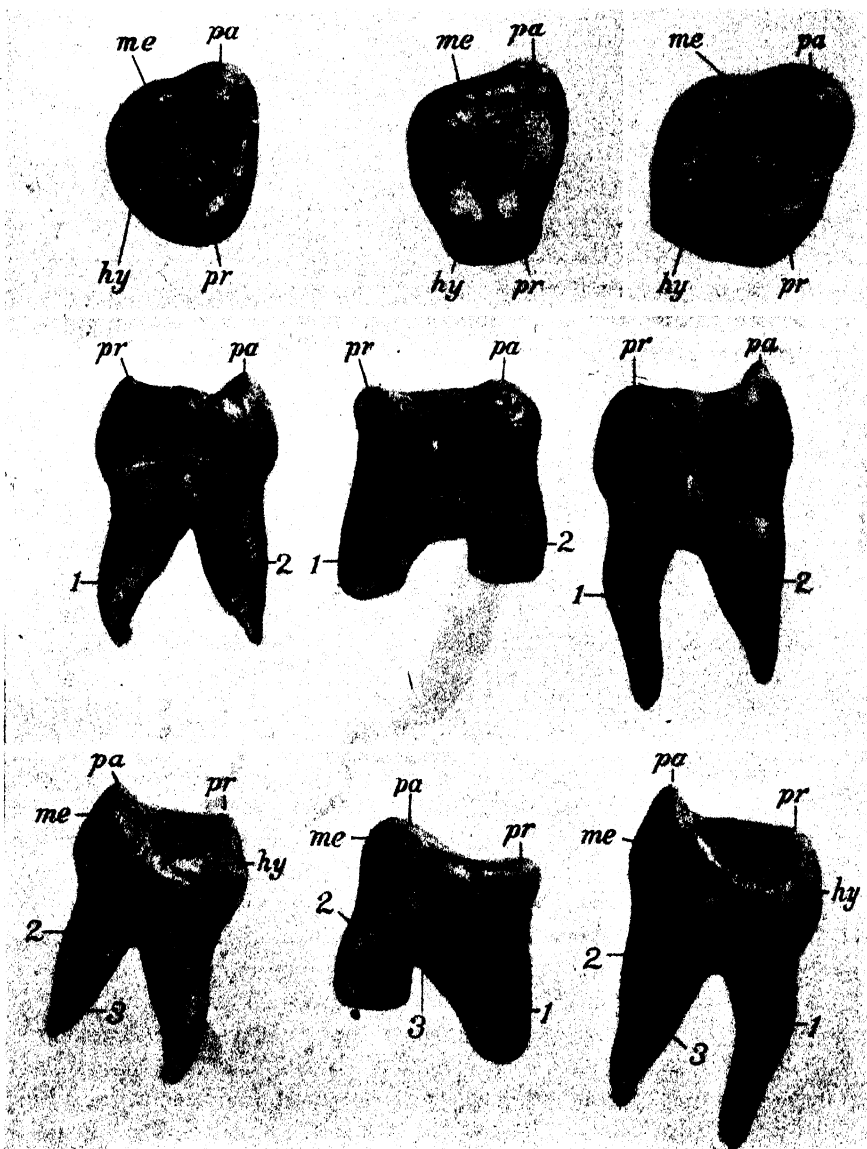


Fig. 1. Comparative figures of upper molars of *Hesperopithecus* and modern chimpanzee (*Pan schweinfurthii*), $\times 2$.

UPPER ROW: occlusal aspect, third upper molar of chimpanzee, second (?) upper molar, type of *Hesperopithecus*, second upper molar of chimpanzee.

MIDDLE ROW: anterior (mesial) aspect of same specimens.

LOWER ROW: posterior (distal) aspect.

Pr, protocone (mesio-lingual cusp); *pa*, paracone (mesio-buccal); *me*, metacone (disto-buccal); *hy*, hypocone (disto-lingual). 1, lingual root; 2, antero-external (mesio-buccal) root; 3, postero-external (disto-buccal) root or site of same.

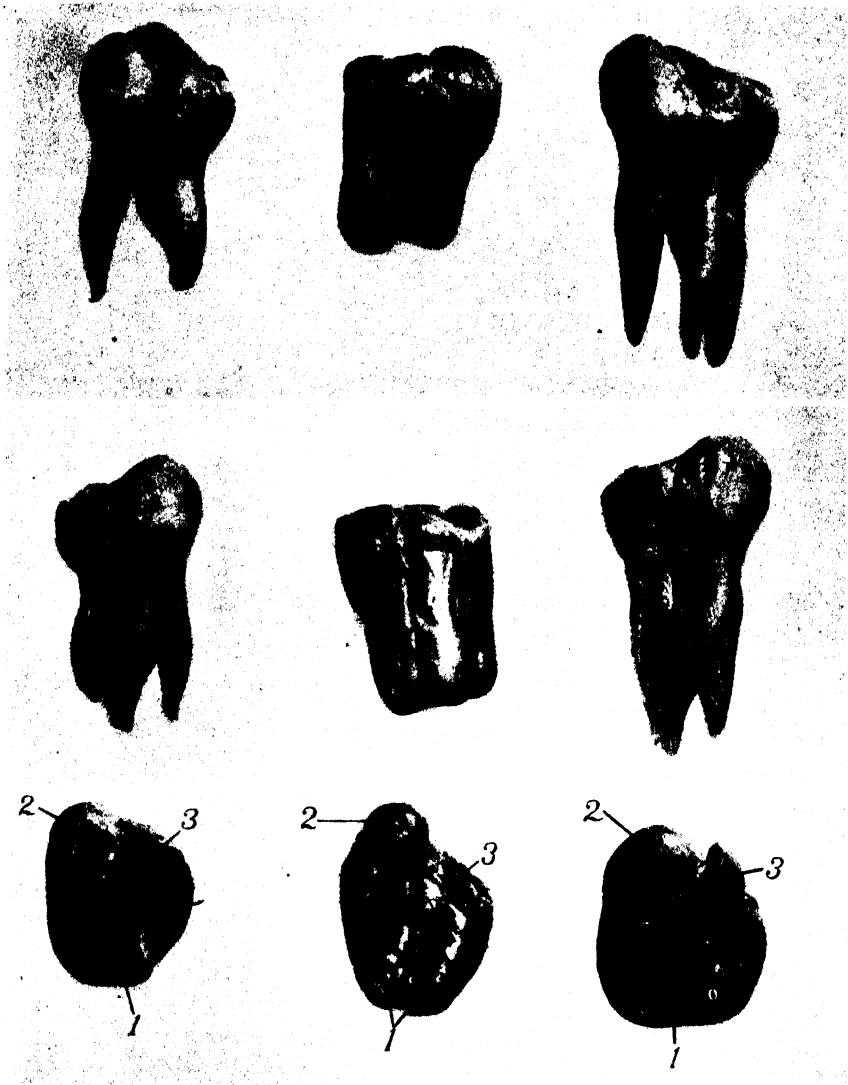


Fig. 2. Comparative figures of upper molars of *Hesperopithecus* and modern chimpanzee (continued), $\times 2$.

UPPER ROW: buccal aspect, m^3 chimpanzee, m^2 (?) *Hesperopithecus*, m^2 chimpanzee.

MIDDLE ROW: lingual aspect, same series.

LOWER ROW: view from above, showing roots.



Fig. 3. Comparative figures of upper molars of *Pithecanthropus*, *Hesperopithecus* and modern American Indian, $\times 2$.

UPPER ROW: occlusal aspect, second upper molar (cast) referred to *Pithecanthropus*, type upper molar of *Hesperopithecus*, and second upper molar of modern American Indian (ground down to near base of crown).

MIDDLE ROW: anterior or mesial view of same series.

LOWER ROW: posterior or distal view of *Pithecanthropus*, *Hesperopithecus*, and m¹ American Indian.



Fig. 4. Comparative figures of upper molars of *Pithecanthropus*, *Hesperopithecus* and modern American Indian (continued).

UPPER row: view from above, showing roots; second upper molar (cast) referred to *Pithecanthropus*, type upper molar of *Hesperopithecus*, first upper molar of American Indian (postero-external root broken off).

MIDDLE row: lingual aspect of same specimens.

LOWER row: occlusal aspect of molars of American Indians. Second upper molar ground down to near base of crown, second upper molar of opposite side natural wear, first upper molar much worn.

TABLE I.—COMPARATIVE MEASUREMENTS¹ AND INDICES OF *HESPEROPITHECUS* TYPE UPPER MOLAR

	<i>Hesperopithecus</i> Type m ² ?	Chimpanzee A. M. N. H. m. ² 51278	Chimpanzee A. M. N. H. m. ² 51278	<i>Pithecanthropus</i> Cast m ²	American Indian A. M. N. H. m. ² 2161 Crown ground down	American Indian A. M. N. H. m. ² 2161 Natural wear	American Indian A. M. N. H. m. ² 22166 Natural wear
a.—Antero-post. diam. middle of crown at base	10	10	11.5	12	10	10.2	10
b.—Distance inner base protocone to outer base paracone	12	12	13	13.4	12.2	12.5	12.3
Index 1: Relative transv. width ant. moiety of crown [$b \times 100 \div a$]	120	120	113	112	122	123	123
c.—Distance inner base hypocone to outer base metacone	10.2	9	10.7	11.5	11.5	11.8	12
Index 2: Relative transv. width post. moiety of crown [$c \times 100 \div a$]	102	90	93	96	115	116	120
d.—Distance ant. base paracone to post. base metacone	10.5	10.2	11.8	12.2	10.8	10.8	11.2
Index 3: Relative ant. post. diam. outer margin of crown [$d \times 100 \div a$]	105	102	103	102	108	106	112
e.—Distance ant. base protocone to post. base hypocone	9.3	9.2	10.5	11.7	9.5	10	9.8
Index 4: Relative ant. post. diam. inner part of crown [$e \times 100 \div a$]	93	92	91	97	95	100	98
f.—Angle of outer border of crown to ant. border	62°	68°	60°	60°	70°	70°	70°
g.—Ant. post. diam. lingual root	6.8	5	6.2	7.7	5.7	5.7	6.5
Index 5: Relative ant. post. diam. of lingual root [$g \times 100 \div a$]	68	50	54	64	57	56	65
h.—Angle of axis of lingual root to that of antero-buccal root	21.5°	25°	22.5°	m ² 27° m ³ 35°	5°	5°	18°

¹Measurements are in millimeters.

TABLE II.—VARIABILITY OF ANGLE OF AXIS OF LINGUAL ROOT TO THAT OF ANTERO-BUCCAL ROOT IN HUMAN MOLARS

	Am. Ind.		Bedouin		White Man	Am. Ind.	
	A. M. N. H. 2161	A. M. N. H. 22166	A. M. N. H. 7224	A. M. N. H. 7224		A. M. N. H. 22165	A. M. N. H. 22165
m ²	5°	13°	14°				
m ¹		18°	18°		28°		43°

REMARKS ON THE MEASUREMENTS AND INDICES

(Cf. Tables I, II and Figures 1-4)

The type upper molar of *Hesperopithecus* approaches the third upper molar of a certain chimpanzee in the general dimensions of the base of the crown, that is in four measurements, *a*, *b*, *d*, and *e*, and in two indices, 1, 4. This is the greatest number (six) of agreements recorded in the table. It differs from the same in the much greater relative width of the posterior moiety of the crown (index 2), in the much greater relative antero-posterior diameter of the lingual root (index 5) and in the lesser divergence, or forking, of the lingual and antero-buccal roots (*h*).

It approaches the second upper molar of the same chimpanzee in the transverse diameter of the posterior moiety of the crown (*c*), in the angle of the outer surface of the crown to the anterior surface (*f*), and in the degree of divergence of the axis of the lingual root to that of the antero-buccal root (*h*). All these are important points in favor of the view that the type is an m² rather than an m³.

The type upper molar of *Hesperopithecus* differs from the m² (cast) of *Pithecanthropus* in nearly all the absolute measurements, but approaches it in the great size of the lingual root (index 5), in the angle of the outer side of the crown to the anterior side (*f*), and especially in the evenly concave form of the grinding surface.

While approaching the second upper molars of certain American Indians in four absolute measurements, *a*, *b*, *d*, and *e*, and in two indices, 1 and 3, the type upper molar of *Hesperopithecus* differs widely in the more asymmetrical form of crown with narrower posterior moiety (index 2),¹ in the greater size of the lingual root and especially in the greater

¹The apparent asymmetry and relative narrowness of the posterior moiety of the crown in the type may be due in a considerable degree to the advanced condition of wear in the region of the hypocone. A difference of this character may be noticed in the comparison of a less worn and a more worn second upper human molar of the same dentition (Figure 3).

divergence of the lingual and antero-buccal roots,¹ and in the smaller transverse diameter of the antero-buccal root.

The marked asymmetry and small transverse diameter of the posterior moiety are pronounced in the second upper molar of the "Mousterian youth" of the Neanderthal race, as well as in certain Australian skulls

The type of *Hesperopithecus* approaches the first upper molar of a certain American Indian (Table I) in three important characters (*a*, *g*, and index 5).



Fig. 5. Comparative radiographs of upper molars of chimpanzee, *Hesperopithecus* and American Indians.

UPPER ROW: vertical projection; chimpanzee m³, chimpanzee m², *Hesperopithecus*, American Indian m², American Indian m¹.

MIDDLE ROW: antero-posterior projection; chimpanzee m², *Hesperopithecus*, American Indian m², American Indian m¹.

LOWER ROW: transverse projection; chimpanzee m³, *Hesperopithecus*, American Indian m², American Indian m¹.

¹There is, however, a wide range of variability (from 5 to 43°) in this character in man (see Table II).

RADIOGRAPHIC EXAMINATION OF TYPE SPECIMEN

Dr. George Palmer Ratner, D.D.S., has kindly submitted the following report, New York, August 25, 1922.

Under radiographic examination the specimen submitted has the appearance of a molar tooth, i.e., crown portion and two roots: mesial-buccal and lingual; distal buccal apparently missing. Occlusal aspect discloses pulp floor having three openings for three independent roots.

There is present the pulp chamber in crown portion of tooth, also outline of one pulp in mesial-buccal root, terminating in two foramina. Large root, or lingual, discloses two independent pulps present in this root.

Remarks¹

Radiographic examination of the type molar tooth of *Hesperopithecus* reveals a triangular outline of the floor of the pulp chamber. At the angles of this triangle corresponding to the position of the roots there are three openings corresponding with the root canals. The floor of the pulp-cavity is well raised above the bifurcation of the roots, as in man (cf. Fig. 5). The floor of the pulp-cavity resembles that of anthropoids and man.

GEOLOGICAL OCCURRENCE OF THE *HESPEROPITHECUS* TOOTH

In response to our request Dr. W. D. Matthew has kindly supplied the following statement.

This specimen was found by Harold J. Cook in the upper level of the Snake Creek quarries at a point which has been named Oleott Hill, on the ranch of Mr. Harry Ashbrook, twenty miles south of Agate, Nebraska. The Upper Snake Creek at this point consists of sand, pebbles and numerous fragments of bone, forming irregular lenses, or pockets, on the eroded surface of an older formation, the Sheep Creek beds. They appear to be channel-fill lenses and extend for a distance of about three miles to the westward, cropping out at the heads of a series of little 'draws,' or dry gullies on the southwest margin of the sand-hill area between the Niobrara and North Platte valleys. Associated with the channel-beds are finer, uniform, clean sands, partly of eolian deposition, partly water-deposited, and varying in thickness from twenty feet to zero, covered by the sodded surface of the plains.

Fossils are abundant and varied in the channel-beds but mostly very fragmentary and usually rolled or waterworn to a varying degree. Generally they are mineralized to the extent of partly filling the minute canals and pores of the bones, but the larger hollows are either filled with loose sand or empty. The color is usually blue-black from iron phosphate. Sometimes the bones are mottled light yellow, or completely dead white, and the degree of mineralization varies to a considerable extent.

The finer sands contain the same or a slightly later faunal phase but fossils are rare in them, although apt to be well preserved when found.

¹By Milo Hellman.

The fauna found in these upper Snake Creek beds has been extensively collected and carefully studied by the writer, Harold Cook and others. It appears to be a unit fauna and of Lower Pliocene age, save for occasional specimens of the Upper Miocene Lower Snake Creek fauna, presumably due to re-deposit. Except for a single specimen, a Bison jaw found on the surface in 1908 (we have no exact record or recollection of the exact circumstances), no fossils have been found at this locality which would indicate an admixture of Upper Pliocene, Pleistocene or recent faunas. Thousands of equid teeth have been found, all of the older Pliocene (or Upper Miocene) species, not one that would suggest Pleistocene age. In view of the great number of fossils it is safe to say that no Pleistocene admixture is present.

As regards the *Hesperopithecus* tooth, it was found by Mr. Cook in place in the Upper Snake Creek channel-beds, and as the finder is an experienced geologist and palæontologist, thoroughly familiar with this fossil locality and the fauna, his reports and conclusions are considered exceptionally valid proof of its occurrence. The preservation of the tooth is entirely normal and similar to the rest of the Upper Snake Creek fauna.

The following list of the associated fauna is not complete, but suffices to show its relations:

- Carnivora.—Ursidæ—*Hyænarcos* sp.
- Mustelidæ—*Brachypsalis* sp.
- Canidæ—*Aelurodon haydeni* var.
- “ *sævus* var.
- Felidæ—*Machærodus* sp.
- Perissodactyla.—Equidæ—*Pliohippus leidyanus*
- “ cf. *mirabilis*
- Protohippus* cf. *perditus*
- “ *placidus* var.
- Hipparion affinis*
- “ *gratum* var.
- Rhinocerotidæ—*Peraceras* sp.
- Aphelops* sp. indesc.
- Teleoceras* cf. *fossiger*
- Artiodactyla.—Dicotylidæ—*Prosthennops* cf. *serus*
- Camelidæ—*Alticamelus* cf. *procerus*
- Pliauchenia gigas*
- ?*Procamelus* sp.
- Cervidæ—? *Cervavus* sp.
- Antilocapridæ—? *Merycodus* sp.
- Bovidæ—*Neotragoceras improvisus*
- Edentata.—Megalonychidæ—*Megalonyx* cf. *leptostomus*
- Glires.—Sciuridæ—*Sciurus* cf. *aberti*
- Mylagaulidæ—*Mylagaulus* sp.
- Geomyidæ—*Thomomys* sp.
- Proboscidea.—Mastodontidæ—*Miomastodon matthewi*
- Trilophodontidæ—? *Trilophodon* sp.
- Insectivora.—Talpidæ—*Scalops* sp.

The above fauna is comparable with that of the Republican River of Kansas, Nebraska and Colorado, with the Rattlesnake of the John Day basin in Oregon, the

Thousand Creek beds of Nevada and various early Pliocene formations in the western United States. These are regarded by Osborn, Merriam and the writer as a practical equivalent in a broad way of the *Hipparion* fauna of Europe and Asia, which is assigned by most authorities to the Lower Pliocene.

The above data are considered by the writer to furnish fairly conclusive proof of the Lower Pliocene age of the *Hesperopithecus* tooth. There is no reasonable doubt as to its age.

CONCLUSIONS

1.—The differences from the third lower molar of *Hyænarcos*, with which Dr. Smith Woodward¹ suggested that the type upper molar of *Hesperopithecus* should be compared, are so fundamental that it is difficult to find any significant points of agreement. The third lower molar of *Hyænarcos* and of the modern bears has been derived by degeneration of a normal tuberculo-sectorial molar, as may be seen readily by comparison with various amphicyonines and other canids, while the molar of *Hesperopithecus* very clearly conforms to the modified tri- to quadritubercular type that is characteristic of the upper molars of anthropoid apes and man. The illustrations in the plates surely establish this beyond reasonable dispute.

2.—The posterior upper molar of the procyonid carnivore *Cercoleptes* (*Potos*) shows a distant resemblance to the type of *Hesperopithecus* which does not stand close comparison.

3.—There is a certain superficial resemblance of the worn third upper molar crown of *Lagothrix*, a South American monkey, to the type of *Hesperopithecus*. But in the former the lingual root in old specimens is directed strongly upward and backward, while in the latter it is directed upward and forward, with reference to the general plane of the masticating surface. Moreover, the great differences in size and in the detailed characters of the teeth do not favor the possibility of a near relationship of the two genera.²

4.—Of the higher primates, the Old World monkeys are excluded from close relationship to *Hesperopithecus* by the oblong contour of the upper molar crown; the gibbons come nearer but have much smaller molars, which are more elongate antero-posteriorly; in the gorilla, the antero-posterior elongation attains an extreme, and this ape also surpasses *Hesperopithecus* in the antero-posterior width of the lingual root and in the degree of its divergence from the outer roots; the orang has

¹Woodward, A. Smith, F. R. S., 1922, 'A Supposed Ancestral Man in North America.' *Nature*, CIX, No. 2745, p. 151.

²Comparisons with all other known genera of South American monkeys show marked differences from the type of *Hesperopithecus* either in crown or roots.

quadrate molar crowns with extremely wide lingual roots¹; the chimpanzees, while varying considerably in molar characters, appear to come nearest to *Hesperopithecus*, but the specimens here figured differ from it in the weakness of the roots, in the lingual reflection of the enamel upon the neck, and in the greater relative antero-posterior diameter of the crown (assuming that the type of *Hesperopithecus* is either an m^2 or an m^1).²

5.—Our results thus afford additional evidence in favor of Professor Osborn's conclusion³ that the type of *Hesperopithecus haroldcookii* represents an hitherto unknown form of the higher primates. It combines characters seen in the molars of the chimpanzee, of *Pithecanthropus*, and of man, but, in view of the extremely worn and eroded state of the crown, it is hardly safe to affirm more than that *Hesperopithecus* was structurally related to all three.

6.—Whether *Hesperopithecus* itself is or is not ancestral to man can only be determined by subsequent discovery, but meanwhile the only part definitely known of it, namely, the much worn type upper molar, represents a stage of evolution which comparative morphological evidence indicates as preceding the following definitely human specializations: (a) the reduction of the lingual root; (b) the lessening of the divergence of the lingual and buccal roots; (c) the widening of the antero-external root; (d) the antero-posterior shortening and transverse widening of the crown; (e) the tendency toward rectifying the asymmetry due to the narrowness of the posterior moiety of the crown. The *Hesperopithecus* molar shows the opposites of all these characters and such an assemblage of primitive features has not hitherto, so far as we are aware, been found in any single human molar.

7.—The anatomical, palæontological, and other evidence⁴ already accumulated tends to show that man, *Pithecanthropus*, *Hesperopithecus*, and the various anthropoids form a natural superfamily group, which may now be named the **Hominioidea**, in contrast with the **Cercopithecoidea**, or Old World monkeys.

8.—The palæontological, anatomical, and taxonomic evidence considered together indicates that the stem forms of this group arose in the early Tertiary times from primates that were closely allied to or identical with the Lower Oligocene *Parapithecus*, which in turn, so far as

¹That is in $m^1 m^2$; m^3 varies greatly.

²Dr. Miller notes that in other specimens of chimpanzees the weakness of the roots seems to hold as a constant character; but that the reflection of the enamel upon the neck may be reduced by wear.

³*Op. cit.*

⁴See W. K. Gregory, 1921, 'The Origin and Evolution of the Human Dentition.'

known, shows a remarkable mingling of characters tending to connect the whole Old World series of primates with the stem of the Eocene tarsoids (Schlosser, Gregory).

9.—There was a wide adaptive radiation of this group in the Middle Tertiary, very diverse species having been found fossil in western and eastern Europe and India. *Hesperopithecus* was one of the Lower Pliocene survivors of this group, which had apparently spread northeastward along the route followed by various mastodons, antelopes, and other mammals described by Professor Osborn.¹

¹Osborn, Henry Fairfield, 1922, '*Hesperopithecus*, the Anthropoid Primate of Western Nebraska,' *Nature*, Aug. 26, 1922, p. 281. For a fuller discussion of the paleontological evidence for the faunal connection of western North America with northeastern Asia in late Tertiary times, see Matthew, W. D., 1915, 'Climate and Evolution,' *Ann. N. Y. Acad. Sci.*, XXIV, pp. 234-255; also Matthew and Cook, 1909, 'A Pliocene Fauna from Western Nebraska,' *Bull. Amer. Mus. Nat. Hist.*, XXXVII, pp. 367-390, 413.

MAMMALS FROM MEXICO AND SOUTH AMERICA

By H. E. ANTHONY

Mr. W. W. Brown has been collecting birds for Dr. L. C. Sanford in the Province of Tamalipas, Mexico, and in a recent shipment were three small mammals which the American Museum acquired by purchase. Upon examination, one of these mammals, a bat related to *Plecotus* and to *Corynorhinus*, has proved to be of an undescribed genus. I am greatly indebted to Mr. Gerrit S. Miller, Jr., for comparing this specimen with the vespertilionid bats in the United States National Museum and also for the loan of specimens of *Plecotus*. Mr. Miller was unable to match this bat with any genus in the collections under his charge and has confirmed my opinion of its distinctness.

IDIONYCTERIS, new genus (Vespertilionidæ)

GENOTYPE.—*Idionycteris mexicanus*, new species.

GENERAL CHARACTERS.—Allied to *Plecotus*, which it resembles in appearance, but being unique among known bats by the possession of two distinct lappets or membranous leaves, which arise near the midline of the band connecting ears across forehead and appear like a pair of misplaced tragi.

DESCRIPTION.—Size about as in *Plecotus*; ears very large and broad, joined across forehead; tragus tall and lanceolate; nostrils simple; glandular outgrowths on nose, if present, very inconspicuous (in dried specimen the nose appears to be without outgrowths); a pair of peculiar membranous processes, arising from the band which connects ears, standing free of the true ear and of each other; a small patch of whitish hair at posterior base of ear; pelage long, lax, silky; skull rather broad; dentition as in *Plecotus*.

Idionycteris mexicanus, new species

TYPE.—No. 62260, Amer. Mus. Nat. Hist., ♀ ad.; Miquihauna, Province of Tamalipas, Mexico; June 17, 1922; collector, W. W. Brown. The type is a skin and skull, both in good condition.

GENERAL CHARACTERS.—In general appearance a typical, big-eared vespertilionid, about the size of *Plecotus*, but readily distinguished by the paired membranous processes arising from the low aural connecting band. (See Figs. 1 and 2.)

DESCRIPTION.—

Ears large and broad, similar in outline to those of *Plecotus* and *Corynorhinus*, outer margin slightly convex, inner margin strongly convex, tips rounded; ears connected across forehead by a low band, from which arises a pair of processes, similar in shape to low, blunt tragi, entirely free from the ear conch and from each

other; tragus tall, slender, simple, with external basal notch; nostrils simple and no glandular masses on muzzle that are apparent on the dried skin; wing membrane normal; interfemoral membrane wide; pelage long, lax and silky.

Color, above, Naples yellow (Ridgway) on tips of hairs which are blackish brown basally; short hair on posterior base of ear conch soiled whitish; hair of upperparts not extending on to wing membranes; only a few scattered hairs on the basal surface of the interfemoral membrane; color, below, almost identical with that above but the hair is shorter and the general appearance is somewhat lighter.

Skull rather broader and more heavily built than that of *Plecotus*, braincase more depressed; general appearance typically vespertilionid.

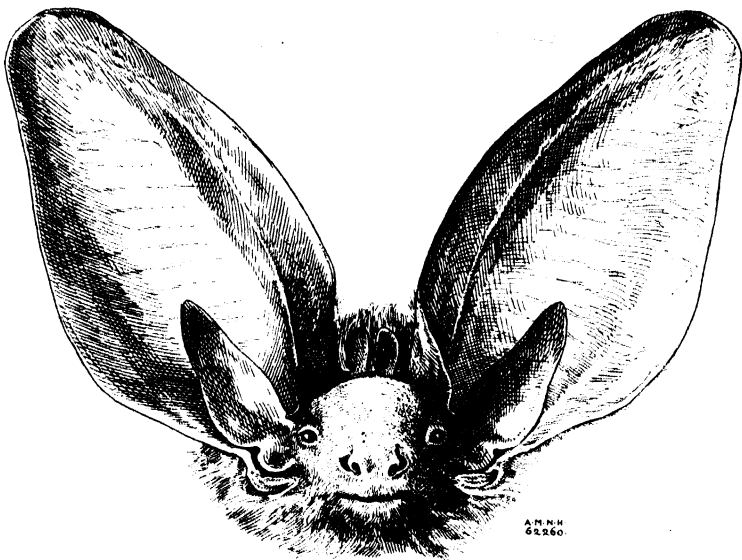


Fig. 1. Head of *Idionycteris mexicanus*, type, about twice natural size.

Dental formula, incisors two above, inner with small basal notch, outer simple, three below, their cutting edges trifold; canines, above and below, of normal height, simple; on lower canine the cingulum rises anteriorly to form decided notch; premolars, above, two, the first minute, crowded between canine and second premolar but within line of toothrow, second premolar with main cusp slightly higher than cusps of molar series, bulk of second premolar about half of first molar; premolars, below, three, second smaller than first, first smaller than third; molars, above, three, the first two subequal, with typical W pattern, third about half as large; molars, below, three, subequal in size, normal in pattern.

MEASUREMENTS.—Taken in the flesh: total length, 110 mm.; tail vertebræ, 50; hind foot, 10; wing expanse, 285; taken from the dried skin; height of ear, from notch, 34; height of tragus, from same point, 12; height of processes, above forehead, 3.5. Greatest length of skull, 17.2; greatest breadth of skull, 9.8; interorbital breadth, 4.4; upper toothrow, incisor to last molar, 6.3.

There appears to be little doubt that the closest relationships of *Idionycteris* are with *Plecotus*. While the general structures of the skulls of the two genera are along slightly different lines, the dentition shows close accord, even to the pattern of the incisors. The inner upper incisor of *Idionycteris* has the accessory cusp low down on the base of the tooth; in *Plecotus* this tooth appears almost to have a bifid cutting edge, the two cusps being subequal in height.

In the character of the accessory processes from the membrane connecting the ears, *Idionycteris*, however, stands unique. These processes are truly a part of the general ear structure but are completely free of the

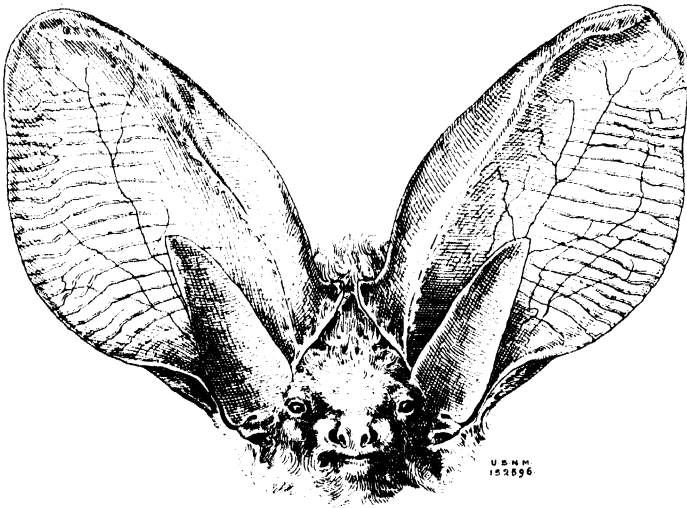


Fig. 2. Head of *Plecotus auritus*, about twice natural size.

conch itself and are not a fold of the connecting membrane. As shown in the figure, they stand erect from the forehead, joined at the base to the connecting band, part of which passes behind them as a low continuous ridge across the head. The internal notch on the ear of *Plecotus* does not appear in any way to be homologous with the processes seen in *Idionycteris*; but it would be a structural possibility for the notch in the ear of *Plecotus* to migrate downward and produce a condition similar to that of the *Idionycteris* ear, so it is not advisable to be too positive on this point.

Compared with *Corynorhinus*, the new genus does not have as many characters in common as it has with *Plecotus*, although the relationship is close. The fact that *Idionycteris* has been compared with *Plecotus*,

an Old World genus, rather than with the New World vespertilionids, is a recognition of the antiquity of the group and the great geographical ranges of its members.

COLOMBIAN MAMMALS

The American Museum, through the kindness of Brothers Apolinar Maria and Nicéfero Maria, of the Instituto de la Salle of Bogotá, Colombia, has received from time to time small collections of mammals made in the vicinity of Bogotá and of Medellín. Some of these mammals have proved to be species new to science and have been described by the late Dr. J. A. Allen. Others are rare and little-known forms which have been no less desirable additions to the Museum's collections. The following list of species is to serve as a catalogue of the mammals received from these enthusiastic naturalists of Colombia and not hitherto published upon.¹

***Didelphis paraguayensis meridensis* Allen**

1902. *Didelphis paraguayensis meridensis* ALLEN, Bull. Amer. Mus. Nat. Hist., XVI, p. 274.

Choachi, 1; Bogotá, 1, juvenile.

These specimens appear to agree well with the series from Merida, the type locality.

***Didelphis marsupialis caucæ* (Allen)**

1900. *Didelphis karkinophaga caucæ* ALLEN, Bull. Amer. Mus. Nat. Hist., XIII, p. 192.

El Poblado, near Medellín, 1.

On geographical grounds, this specimen should be referred to *caucæ* and the agreement with the type specimen, from Cali, Upper Cauca Valley, is quite close.

***Philander laniger cicur* (Bangs)**

1898. *Philander cicur* BANGS, Proc. Biol. Soc. Wash., XII, p. 161.

1913. *Ph[ilander] l[aniger] cicur* THOMAS, Ann. and Mag. Nat. Hist., (8) XII, p. 358.

Fusugasuga, 1; Cordillera del Rusio, 1; Viotá, 1; without locality, 1.

Mr. Oldfield Thomas, in his discussion of the races of *laniger*, *loc. cit.*, gives *cicur* as the form ranging through Santa Marta, Bogotá, and Merida. Owing to the lack of comparative material, and because the

¹For a list of the mammals of Colombia, collected for the American Museum, 1910-1915, which includes the earlier mammals sent in by Brothers Apolinar Maria and Nicéfero Maria, see Bull. Amer. Mus. Nat. Hist., XXXV, Art. 18, pp. 191-238, by J. A. Allen.

specimens under consideration are badly faded, they are assigned to *cicur* on the grounds of geographical distribution.

Marmosa species?

Jerico, Antioquia, 1.

A specimen of *Marmosa*, probably immature, with fragmentary skull, cannot be satisfactorily identified at this time. It is one of the smaller species, grayish in color, and may be either *phæa* or possibly *caucæ*.

Bassaricyon medius Thomas

1909. *Bassaricyon medius* THOMAS, Ann. and Mag. Nat. Hist., (8) XXI, p. 232.
Santa Elena, 1.

A skin, with skull, of this rare species, taken at Santa Elena, agrees well with the type description.

Sciurus (Leptosciurus) pucheranii medellinensis (Gray)

1872. *Macrozus medellinensis* GRAY, Ann. and Mag. Nat. Hist., (4) X, p. 408.

1915. *Leptosciurus pucheranii medellinensis* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIV, p. 202.

La Ceja, 1; La Laguna, 2; Santa Elena, 5.

This series varies somewhat in coloration but not to any great extent.

Mus musculus musculus Linnæus

1758. *Mus musculus* LINNÆUS, 'Syst. Nat.,' I, p. 62.

Paramo de Choachi, 1; El Granizal, near Medellin, 1.

Oryzomys pectoralis Allen

1912. *Oryzomys pectoralis* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXI, p. 83.

La Ceja, 1.

This specimen agrees quite well with the large series of *pectoralis* from Colombia in this museum. The range of the species of *Oryzomys* allied to *albigularis* of Tomes has not been very well worked out; and, while there have been a number of species described which all bear considerable resemblance not only to *albigularis* but to each other, so that some should doubtless be dealt with as synonyms, on the other hand, the factors of geographical separation and local environment must be taken into consideration. It is difficult to believe that a species of a genus as plastic as *Oryzomys* appears to be can range over the Andean system without becoming differentiated in some way. More material is needed to establish the standing of this group of species which are too

closely related to one another to be all accorded full specific rank. Dr. Osgood in 1914, in his 'Mammals of an Expedition Across Northern Peru,' Field Mus. of Nat. Hist., X, No. 12, p. 159, points out this similarity and would synonymize *O. childi*, *O. o'connelli*, and *O. pectoralis* with *O. meridensis*, a treatment which has much to commend it, but which in some respects may fail to allow for wide geographical separation.

***Oryzomys (Oligoryzomys) dryas humilior* Thomas**

1898. *Oryzomys dryas humilior* THOMAS, Ann. and Mag. Nat. Hist., (7) II, p. 268.

Choachi, Bogotá region, 4.

The type locality of *humilior* is given as "Plains of Bogotá," hence this series may be assumed as being practically topotypical. Two specimens are in good condition, although the skulls are badly broken, while the other two are not of much value for comparison. The former agree well with the type description, the black ears being especially diagnostic.

***Oryzomys* species?**

La Ceja, 1.

This specimen is a native-made skin with a badly fractured skull, and I am unable to match it satisfactorily with any *Oryzomys* in the collection of the American Museum or any that I have seen described. The skull is typically oryzomine while the animal is of medium, robust build, hind foot about 24 mm. in length. In color and texture of fur it closely resembles *Thomasomys cinereus*.

***Oryzomys* species?**

Susumuco, 2; Rio Guatemala, 1.

These three specimens belong to the short, velvety-furred section of the genus. They resemble *palmiræ* Allen somewhat in appearance but seem to be too large for that species. Geographically, the region where they were taken is rather distant from the type localities of all of the other velvet-furred *Oryzomys*, some of which are known to me only from descriptions, and I am reluctant to assign a definite specific name upon the basis of the available material.

***Melanomys buenavistæ* Allen**

1913. *Melanomys buenavistæ* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXII, p. 547.

Susumuco, near Villavicencio, 1.

This specimen lacks a skull but there is little hesitation in referring it, on the basis of close agreement in external characters, to *buenavistæ*, the type locality of which is very near to Susumuco.

Thomasomys laniger (Thomas)

1895. *Oryzomys laniger* THOMAS, Ann. and Mag. Nat. Hist., (6) XVI, p. 59.

1917. *Thomasomys laniger* THOMAS, Ann. and Mag. Nat. Hist., (8) XX, p. 196.

Paramo de Choachi, 3.

These specimens agree fairly well with the type description and, since the type of *laniger* came from the Bogotá region, they may be assumed to be topotypical.

Thomasomys cinereiventer Allen

1912. *Thomasomys cinereiventer* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXI, p. 80.

Le Ceja, 1.

This specimen appears to have a noticeably smaller foot than that of typical *cinereiventer* and more material may disclose the presence of an undescribed form about the Medellín region. In coloration and general appearance, the specimen matches very well the large series of *cinereiventer* from Colombia, now in this museum.

Rhipidomys species?

Susumuco, Bogotá region, a skin without skull.

This specimen has the appearance of typical *Rhipidomys*, with short feet darkened along the metapodials, hind foot about 30 millimeters in the dried skin. The tail is about 170 mm., approximately the length of head and body. The fur of upperparts is mixed clay-color and black, of underparts cream-color.

Lacking specimens of *Rhipidomys* from the eastern slopes of the eastern Andes for comparison, it is impossible to identify this skin at the present time.

Akodon chapmani Allen

1913. *Akodon chapmani* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXII, p. 600.

Choachi, 1.

Microxus bogotensis (Thomas)

1895. *Acodon bogotensis* THOMAS, Ann. and Mag. Nat. Hist., (6) XVI, p. 369.

Paramo de Choachi, 1.

This specimen appears to agree well with the type description given by Thomas.

***Proechimys o'connelli* Allen**

1913. *Proechimys o'connelli* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXII, p. 479.

Villavicencio, 2.

These specimens are topotypical since the type, collected by G. M. O'Connell, was taken at Villavicencio. Only one of the specimens is adult and it is somewhat darker along the back than the type.

***Anoura geoffroyi apolinari* (Allen)**

1916. *Glossophaga apolinari* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXV, p. 86.

1921. *Anoura geoffroyi apolinari* ANTHONY, Amer. Mus. Novitates, No. 20, p. 6.

Bogotá region, a skin, without skull.

This specimen is practically topotypical since the type locality is Boqueron de San Francisco, near Bogotá.

***Vampyrops*?**

Choachi, near Bogotá, one skin without skull.

This specimen presents, in general, the characters of *Vampyrops*, but lacks any light-colored striping on back or face. It is a native-made skin and without a skull it is difficult to make more than provisional identification. It is unlike any species of *Vampyrops* in the collection of the American Museum and possibly represents an undescribed form. In size it approximates *Vampyrops lineatus* and has densely haired hind legs and feet.

***Hemiderma perspicillatum* (Linnæus)**

1758. *Vespertilio perspicillatus* LINNÆUS, 'Syst. Nat.,' 10th Ed., p. 31.

1907. *Hemiderma perspicillatum* HAHN, Proc. U. S. Nat. Mus., XXXII, p. 108.

Rio Guatequia, 1.

This specimen is quite noticeably reddish brown, brighter than any of the series of *perspicillatum* from Colombia, in this Museum. The forearms are broken, so that measurements cannot be taken, and it appears best to include it under the name that has always been used hitherto for Colombia *Hemiderma*.

***Glossophaga soricina soricina* (Pallas)**

1766. *Vespertilio soricinus* PALLAS, Miscell. Zool., p. 48.

Paramo de Choachi, 1.

Desmodus rotundus (Geoffroy)1810. *Phyllostoma rotundum* GEOFFROY, Ann. Mus., XV, p. 181.1826. *Desmodus rufus* WIED, Beitr. Naturg. Brasil, p. 233.

La Ceja, near Medellin, 1.

This specimen presents no characters calling for special comment.

Lasiurus varius (Poepig)1835. *Nycticeius varius* POEPPIG, 'Reise in Chile,' I, p. 451.

Near Bogotá, 1.

This specimen is called *varius* more because of the convenience of following such a blanket name than because of a fixed belief that the Colombian specimen actually is identical with Poepig's species. Owing to lack of comparative material and the apparent confusion of earlier writers in dealing with the reddish South American *Lasiuri*, it is impossible to do more than adopt some such temporary expedient.

Myotis caucensis Allen1914. *Myotis caucensis* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXIII, p. 386.

Bogotá region, 1.

This specimen agrees fairly well with the type, which came from the valley of the Rio Cauca.

Molossus bondæ Allen1904. *Molossus bondæ* ALLEN, Bull. Amer. Mus. Nat. Hist., XX, p. 228.

Bogotá region, 1.

The type of *bondæ* is reddish brown but topotypes are darker indicating that the species is dichromatic. The Bogotá specimen is between warm sepiæ and bister in coloration.

Aotus lemurinus (I. Geoffroy)1844. *Nyctipithecus lemurinus* I. GEOFFROY, Arch. du Mus. d'Hist. Nat. de Paris, IX, p. 24, Pl. II.1916. *Aotus lemurinus* ALLEN, Bull. Amer. Mus. Nat. Hist., XXXV, p. 234.

Muzo, northwest of Bogotá, 1.

The Muzo specimen has no black on hands or feet, which are rather grayish in color, nor has it any black areas on the tail. The pelage is decidedly worn however and, taking into consideration the amount of individual variation in the genus and the fact that the type series of *lemurinus* came from near Bogotá, the specimen is given the older name of Geoffroy's rather than to follow the ruling of Dr. Elliot, *loc. cit.*, who synonymized *lemurinus* with *vociferans*.

Cebus fatuellus (Linnæus)

1766. *Simia fatuellus* LINNÆUS, 'Syst. Nat.,' I, p. 42.

1913. *Cebus fatuellus* ELLIOT, 'Review of Primates,' II, p. 102.

Villavicencio, 1.

This specimen agrees well with the description of *fatuellus* as set forth by Elliot, *loc. cit.*, but the range as given by the same author falls rather too far to the west to include Villavicencio, which is on Amazonian drainage.

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PRELIMINARY REPORT ON ECUADOREAN MAMMALS. NO. 3

By H. E. ANTHONY

This is the third paper of a series based upon mammals collected in Ecuador.¹ The field work in Ecuador which has produced the collections that serve as the basis of these preliminary reports was begun in 1920 and has been carried on during part of 1921 and 1922. An expedition is at present in Ecuador visiting regions hitherto unrepresented in the Museum collections. Eventually it is expected that sufficient material will be brought together to justify an extended report on the mammals of this republic. The following new forms have been disclosed by studies of the specimens already at hand.

In making the necessary comparisons with the Ecuadorean series, I have been greatly assisted by the loan of material from the United States National Museum, the Field Museum of Natural History, and the Academy of Natural Sciences of Philadelphia.

Canolestes tatei, new species

TYPE.—No. 61860, Amer. Mus. Nat. Hist.; ♀ ad.; Molleturo, Provincia del Azuay, 7600 feet, Western Andes; June 11, 1922; collector, G. H. H. Tate. The type is a skin and skull with trunk skeleton, in fair condition, the skin having slipped to some extent on the abdomen.

GENERAL CHARACTERS.—Similar to *fuliginosus*, and smaller than *caniventer*; darker in color than either.

DESCRIPTION.—

Color above, everywhere practically unicolor, the soft fur plumbeous black for most of its length and only the extreme tip touched with color, which is near bone-brown (Ridgway); hands paler than color of upperparts; feet dark like back; tail above and below very much like back; ears practically naked, bone-brown.

Color below, lighter than above, hairs tipped with benzo brown; color transition from upper to lower parts very gradual.

Skull essentially as in *fuliginosus*; canine single-rooted; second incisor with shallow posterior notch; third incisor with cutting edge practically continuous; first and second premolars subequal.

MEASUREMENTS.—Taken in the flesh: total length, 213 mm.; tail vertebræ, 117; hind foot, 22. Skull, greatest length, 28.8 (29.7,² 31.4³); length of nasals, 13.8 (12.7,

¹For first and second papers, see 'Preliminary Report on Ecuadorean Mammals. No. 1,' American Museum Novitates, No. 20, November 3, 1921, and 'Preliminary Report on Ecuadorean Mammals. No. 2,' American Museum Novitates, No. 32, March 4, 1922.

²Measurement of skull of *Canolestes fuliginosus*, ♀, No. 12742, Acad. Nat. Sci. Philadelphia, Mt. Pichincha, Ecuador.

³Measurements of skull of *Canolestes caniventer*, ♀, No. 47176, Cordillera de Chilla, Ecuador.

15); zygomatic breadth, 13.2 (13.9, 14.2); interorbital breadth, 7.2 (7.5, 7.8); length entire upper tooththrow, 15.1 (16, 17.3); length of upper molar series from pm³ to M⁴, 6.6 (6.7, 7.3); greatest breadth of palate, across outside margins of molar series, 7.3 (7.6, 7.7).

Cænolestes tatei is easily distinguishable from either *fuliginosus* or *caniventer* by its darker coloration. In this respect it comes closest to *fuliginosus*, and another point of resemblance is shown by the soft, lax character of the fur in both of these forms, while the fur of *caniventer* is noticeably harsher. The differentiation of color between upper and lower parts of *tatei* is but slight, a greater degree being shown by *fuliginosus* but the greatest, amounting to a conspicuous difference, being evident in *caniventer*.

There are apparently no marked skull differences to distinguish *tatei* from *fuliginosus*. The character of the notched second incisor deserves special comment, as this feature is quite evident in *tatei*. That the condition of the cutting edges of the broad second and third upper incisors may prove to be a character of considerable diagnostic value is strongly hinted by the series of skulls of *Cænolestes* now before me. A series of eight skulls of *caniventer* show second and third incisors very distinctly notched, while skulls of *fuliginosus* and *obscurus* have only the second incisors notched in *fuliginosus* and no incisors notched in *obscurus*. *C. tatei* presents a condition more or less intermediate between the two extremes represented by *caniventer* and *obscurus*. Dr. W. H. Osgood, in his important monograph of *Cænolestes*, makes no mention of notches in the cutting edge of the second and third upper incisors, so it is presumed that his series of *obscurus* lacked this character.

The discovery of a new species of *Cænolestes* at a locality between the known ranges of *fuliginosus* and *caniventer* is most interesting and demonstrates the need of systematic collecting before it can be said that much is known of the genus. The altitude of Molleturo, 7600 feet, an elevation much below that of the Pichincha region, from whence most of the specimens of *fuliginosus* have come, probably explains the differentiation shown by the new species. Molleturo is on the western flank of the Western Andes, in a belt of heavy rainfall, a densely forested slope, and the environmental conditions are quite distinct from the high paramo uplands about Pichincha.

It is also of interest to note that a series of three *Cænolestes* were taken at Molleturo, two of them apparently *caniventer*, although rather dark in color and only one of the quite distinct *tatei* pattern.

I take pleasure in naming this new form in honor of Mr. G. H. H. Tate, who collected it. The activities of Mr. Tate as a mammal collec-

tor for the American Museum have resulted in the acquisition of some hundreds of specimens and the capture of this recent series of *Cænolestes* is one of the results of his energy.

***Thomasomys hudsoni*, new species**

Fig. 1, A and B, natural size

TYPE.—No. 47690, Amer. Mus. Nat. Hist.; ♂ ad.; Bestion, Provincia del Azuay, 10,100 feet, Ecuador; January 13, 1921; collector H. E. Anthony. The type is a skin and skull, both in good condition.

GENERAL CHARACTERS.—Similar to *gracilis* Thomas in general superficial characters but having a peculiarly shaped nasal region which differs from that of any hitherto described *Thomasomys*.

DESCRIPTION.—

Color above, between Dresden-brown and mummy-brown, darkest along dorsal area; fur long and soft; hands and feet hair-brown, the claws surrounded by short whitish hairs; tail long and slender, colored like feet, unicolor, sparsely clothed with fine hairs.

Color below, warm buff, no line of demarcation where color of upperparts merges into that of lower parts. Hairs above and below with plumbeous black bases.

Skull normal in all respects except through frontal and nasal region; frontals somewhat inflated, nasals slightly concave in dorsal outline and rounded to form a slender, subcylindrical tube; incisive foramina not quite extending to plane of first molar teeth; bullae of medium size, inflated.

MEASUREMENTS.—Taken in the flesh: total length, 213 mm.; tail vertebræ, 120; hind foot, 23. Skull, greatest length, 25.2 (24.5)¹; length of nasals, 8.7 (8.3); zygomatic breadth, 13.3 (13.1); breadth of braincase, 12.1 (12); interorbital breadth, 4.2 (3.7); length of incisive foramina, 4.4 (4.6); length of upper molar series, 3.5 (3.7).

The skin of *hudsoni* may be closely matched by a specimen of *gracilis*, No. 194786, U. S. N. M., Torontoy, Peru, the two being almost identical in color, above and below, although two other specimens of the Heller collection, from Lucma, are much brighter colored. The best basis of separation is the peculiar tube-like character of the nasals of *hudsoni* and their concave, "dished-in" appearance when viewed in profile. Each of the three skulls of *gracilis* now before me present flattened nasals, with a longitudinal depression extending along the basal three-quarters of their length, and show none of the lateral convexity so obvious in *hudsoni*. However, the closest relationships of *hudsoni* are evidently with *gracilis*, and the new form needs no detailed comparison with other species of *Thomasomys*.

Out of a series of eighteen *Thomasomys* collected at Bestion, only one proves to be *hudsoni*, all of the remainder being *bæops* (?). Bestion

¹Skull of *Thomasomys gracilis*, No. 194812, U. S. N. M., "♂", Lucma, Peru.

is in the south temperate zone but almost at the upper limit of forest. Most of the locality is comprised of rolling grassy meadows with scrub trees on some of the ridges and with thickets of brush on some of the slopes.

This species is named for Mr. W. C. Hudson, who at the time the expedition was at Bestion was camped along the Rio Shingata and in charge of exploration work for the South American Development Company. Mr. Hudson rendered great service to members of the party and will be long remembered as a most generous host.

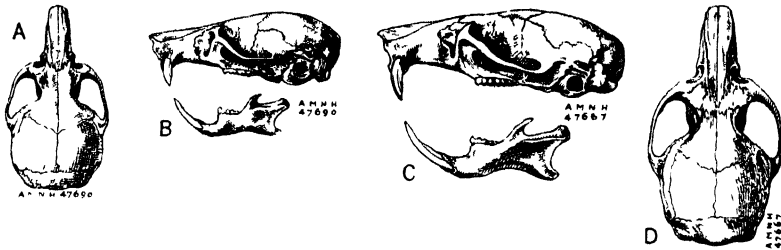


Fig. 1. Skulls of *Thomasomys*

A, B. *Thomasomys hudsoni*, type.
C, D. *Thomasomys caudivarius*, topotype.

Thomasomys caudivarius, new species

Fig. 1, C and D, natural size

TYPE.—No. 47668, Amer. Mus. Nat. Hist.; ♂ ad.; Taraguacocha, Cordillera de Chilla, 10,750 feet, Provincia del Oro, Ecuador; August 23, 1920; collector H. E. Anthony. The type is a skin and skull, both in good condition.

GENERAL CHARACTERS.—A good sized species of the *cinereus* group, soft-haired, near mummy-brown of Ridgway above, tip of tail white.

DESCRIPTION.—

Color above, between mummy-brown and clove-brown, only the extreme tips of the hairs colored, the rest of the hair being plumbeous black to the base; somewhat lighter in color along the sides; hands and feet approaching color of upperparts but lighter; tail practically as dark below as above, mouse-gray proximally, hairs short but abundant, the annulations of the tail very conspicuous, terminal fifth of tail clear white; short tufts of glistening white hairs on bases of claws of feet.

Color below, everywhere near chamois, but with the dark bases of the hairs showing through to give much darker impression.

Skull similar to that of *cinereus*, nasals well expanded anteriorly, interorbital region rounded without beading of any sort; a small median depression just at nasal suture; braincase less inflated than in *cinereus*; incisive foramina and interpterygoid fossa scarcely extending to planes of anterior and posterior molars respectively; bullae small, elongate, showing very little inflation.

MEASUREMENTS.—Taken in the flesh: total length, 275 mm.; tail vertebrae, 161; hind foot, 30. Skull, greatest length, 31.9 (32.2)¹; length of nasals, 11.3 (12.7); zygomatic breadth, 16.9 (16); interorbital breadth, 5.2 (5.5); breadth of braincase, 14.2 (15.1); length incisive foramina, 6 (6.3); length of upper molar series, 5.1 (5.3); dimensions of auditory bulla, 5.4×4 (5.9×4.6).

T. caudivarius is separable on the basis of color alone from *cinereus*, *ischyrus*, *laniger*, *paramorum*, and *hylophilus*, the species of *Thomasomys* which by their pattern of coloration, character of fur, and size appear to be most nearly related to the new form. There are available for comparison fourteen specimens of *caudivarius*, all topotypes, of different ages, so that individual variation need not be an uncertain quantity. The series is quite uniform and none of them shows the brighter shades of brown seen in the species just listed. The character of the white-tipped tail appears to be of diagnostic value but is variable in its extent. The amount of white shown ranges from a conspicuous tip, almost one-quarter of the total length of the tail, to a white terminal pencil.

The cranial characters bear out the differences shown superficially, for *caudivarius* has very small bullae and they are elongate, with very little inflation.

Thomasomys hylophilus Osgood, from the Paramo de Tama, Venezuela and Colombia, is a close relative of *caudivarius* and, like it, has a white-tipped tail. Aside from the more pronounced olivaceous appearance of *caudivarius*, there is a noticeable difference in the hind feet of the two species. *T. caudivarius* has a longer and broader foot than *hylophilus*, but the identity in skull structure indicates that the two species are rather closely related. Geographically, they are separated by the breadth of the Andean system, since *hylophilus* is found on the eastern slopes of the Andes, *caudivarius* on the Western Andes.

T. cinereiventer is much larger than *caudivarius*, with much larger bullae, but externally the two species are much alike in coloration.

Most of the type series of *caudivarius* were taken along a small mountain brook which flowed down a steep narrow valley. The sides of the valley were densely covered with thick shrubbery and low stunted trees. Along the same stream, another species of *Thomasomys*, of smaller size, probably *T. bæops* Thomas, was common, the same trap perhaps taking the two species on alternate nights. *Thomasomys auricularis* (a new species described hereafter) was caught in this same locality, making three distinct species of the genus for that region. *T. caudivarius* was also taken out on the open paramo where there were no trees but an abundance of low shrubbery.

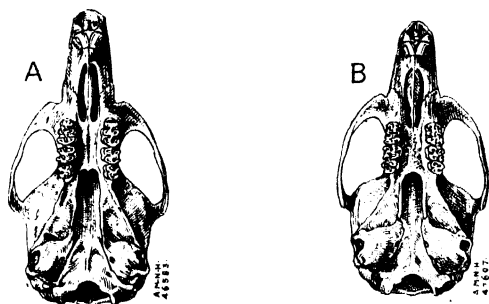
¹Skull of *Thomasomys cinereus*, No. 19807, Field Museum, ♂ ad., from Mts. E. of Balsas, Peru.

Thomasomys auricularis, new species

Fig. 2, B, natural size

TYPE.—No. 47697, Amer. Mus. Nat. Hist.; ♂ ad.; Taraguacocha, on trail from Zaruma to Zaraguro, altitude 10,250 feet, Cordillera de Chilla, Provincia del Oro, Ecuador; August 26, 1920; collector, H. E. Anthony. The type is a skin and skull, both in good condition.

GENERAL CHARACTERS.—A large species, almost equal in size to *aureus* which it resembles superficially, but with light-colored feet, an ochraceous auricular patch, and with auditory bullæ much larger than in *aureus* (see Fig. 2, A).

Fig. 2. Skulls of *Thomasomys*

- A. *Thomasomys aureus*, Pichincha, Ecuador
B. *Thomasomys auricularis*, type.

DESCRIPTION.—

Color above, tawny olive (Ridgway), closely sprinkled with blackish hairs, more especially along midline of back, flanks and sides more strongly tawny; head, lighter in tone than back, buffy brown; a small but conspicuous postauricular tuft of hair ochraceous buff in color; ears dark in color, scantily haired; hands and feet cream-buff above; tail unicolor, hair-brown.

Color below, pinkish buff, the color rather more intense over pectoral area; no line of demarcation in color between sides and underparts; hairs everywhere on body plumbeous black at base.

Skull large and strongly built but smaller than in *aureus*; nasals slender, expanded anteriorly; interorbital region rounded but with a long, shallow median depression; braincase not as inflated as in *aureus*; toothrows normal; incisive foramina long and extending backward just beyond anterior margin of toothrow; interpterygoid fossa not reaching beyond posterior border of last molars; bullæ large and inflated, much larger than in *aureus* or *pratensis*.

MEASUREMENTS.—Taken in the flesh: total length, 345 mm.; tail vertebrae, 190; hind foot, 32. Skull, greatest length, 37.1 (38.8¹, 41.1²); length of nasals, 13.4 (14.1, 14.8); zygomatic breadth, 19.7 (20.4, 21.3); interorbital breadth, 4.4 (5.4, 4.4); length of upper molar series, 6.6 (7.7, 7.5); length of diastema, 8.8 (9.6, 10); length of incisive foramina, 7.7 (7.9, 8); dimensions of bulla, 7.3×6.1 (6.5×4.9, 6.7×5).

¹Skull of *Thomasomys aureus*, No. 46675, A. M. N. H., ♂, Pichincha, Ecuador.

²Skull of *Thomasomys aureus*, No. 194818, U. S. N. M., ♀, Torontoy, Peru.

Thomasomys auricularis is well characterized by its brightly colored postauricular patches and by the large, inflated auditory bullæ. With a very large series of *aureus* before me, most of them from Mt. Pichincha and the Quito region, but including also two specimens from Torontoy, Peru, kindly loaned me by the United States National Museum, I am unable to find any specimens even approaching *auricularis* in size of bullæ. Furthermore, the bullæ of the new species show a degree of inflation that indicates a very distinct separation from the *aureus* stock. While superficially *auricularis* appears to be readily distinguishable from *aureus*, on the other hand, *aureus* is such a variable species that occasionally a specimen is found which resembles *auricularis* in general coloration. However, the presence of a well-developed, ochraceous-buff tuft of hairs behind the ear is not noted in the series of *aureus* now available. *Thomasomys prætor* and *T. popayanus* resemble *auricularis* to about the same degree as does *aureus* and differ from it in the same characters. *Thomasomys aureus altorum* Allen, which I believe further investigation will show to be a synonym of *aureus*, is readily separable upon the basis of the characters given above. *Thomasomys nicefori* Thomas I have not seen but, as its affinities are apparently with *aureus*, and no mention is made of inflated bullæ, I feel that it cannot affect the validity of the species here described.

The type and only specimen of *auricularis* was taken on the bank of a small mountain stream in the Cordillera de Chilla, a short range which extends eastward from the main Western Cordillera. Specimens of *Thomasomys* taken at no great distance from here, in the Western Cordillera at El Chiral, appear, at this time, to be typical *aureus*. The animal was captured in thick forest growth within the limits of the south temperate zone. The same trap line yielded two specimens of *Cænolestes caniventer*.

***Ichthyomys orientalis*, new species**

TYPE.—No. 62382, Amer. Mus. Nat. Hist.; ♀ (?) ad.; near Rio Napo, altitude, 3000 feet, Eastern Ecuador; September 15, 1921; collector, Ludovic Soderstrom. The type is a native-made skin and skull, both in fair condition.

GENERAL CHARACTERS.—A very large species, with highly developed aquatic specializations and sharply bicolored tail.

DESCRIPTION.—

Color above, grizzled black and buff with dark plumbeous tone of underfur showing through, the pelage composed of long, hard, glistening guard hairs and soft, short, woolly underfur; color below, dirty whitish.

Ears like back on upper half, whitish basally; forefeet dusky to digits, then whitish; hind feet near light drab, sparsely haired above, but with heavy marginal fringe of stiff, white hairs; feet broad and web-like; tail like back above, like underparts below, with clear-cut line of demarcation.

Skull large and strongly built, with flaring zygomata and moderate interorbital constriction.

MEASUREMENTS.—Taken from dried skin: total length, 390 mm.; tail vertebrae, 185; hind foot, 38.7. Skull, greatest length, 35.6 (34)¹; greatest breadth (zygomatic breadth), 17.5 (16); length of nasals, 11.5 (11); least interorbital breadth, 4.2 (5); length of palate, 18.2 (17.3); length of diastema, 8.4 (8.9); length of incisive foramina, 6.7 (6.5); length of upper molar series, 4.3 (4.4).

Ichthyomys orientalis needs detailed comparison with only one other species of the genus, namely, *stolzmanni*, none of the other fish-eating rats having a sharply bicolored tail. *I. orientalis* is about the same size as *tweedii*, the tail of which is unicolor, without any white, but an additional character of separation is seen in the hind feet. *I. tweedii* has a highly specialized hind foot but the foot of *orientalis* is even wider and is more heavily fringed with swimming hairs.

In the collections of the American Museum there is a specimen identified as *Ichthyomys stolzmanni*, collected by O. T. Baron at Cajabamba, Peru, in 1895. I suspect that this specimen will prove to be misidentified and probably an undescribed species. I have therefore based comparisons of *orientalis* and *stolzmanni* upon the type description of Thomas, *loc. cit.* *I. orientalis* appears to differ from *stolzmanni* in slightly larger size, coloration less brown, darker forefeet, smaller ears, more flaring zygomata, and greater interorbital constriction.

The type of *orientalis* is a gift to the American Museum from Mr. Ludovic Soderstrom of Quito, who received it from a native collector. Mr. Soderstrom has been particularly successful in collecting specimens of this rare group, and most of these rats in the collections of the different museums have passed through his hands. The type specimens of *Ichthyomys soderstromi*, *Anatomys leander*, *Neusticomys monticolus*, and now *Ichthyomys orientalis*, were all secured by Mr. Soderstrom, whose contributions to Natural Science have shown him to be unusually gifted as a collector.

The label attached to the type of *orientalis* is marked male, but the presence of well-developed mammae, upon inspection of the skin, has caused me to indicate it as a female.

¹Measurements in parentheses are those of the type of *Ichthyomys stolzmanni* Thomas, Proc. Zool. Soc., 1893, p. 340.

SYLVILAGUS

The series of *Sylvilagus* brought from Ecuador by the American Museum expeditions number some twenty-five adult specimens and show the presence of at least three well-differentiated groups there. The *Sylvilagus andinus* group is sufficiently characterized by its sober coloration, inconspicuous nape patch, and grayish underparts, to form a logical assemblage of forms, while the habitat of *andinus*, its subspecies and related species, appears to be the elevated, grassy paramos; at least this has been the case throughout the collecting done in Ecuador. A second group is typified by *daulensis*, a dark, richly ochraceous species inhabiting the forested lowlands of the Guayas basin. The third group has been taken in the subtropical and south temperate forests, from 6000 to 9000 feet elevation. These specimens are marked in more contrasting colors than the *andinus* group, but are not nearly so ochraceous as *daulensis*. Between the first and third groups just enumerated there exist about the same superficial differences as may be noted between *Sylvilagus bachmani* and *S. auduboni* of the United States, *andinus* corresponding to *bachmani*, the third Ecuadorean group to *auduboni*.

I have been unable to find any described species of South American *Sylvilagus* corresponding to the Ecuador specimens of this third group and consequently two forms are here described. Unfortunately, the American Museum collections are weak in Neotropical Leporidæ and hence lack good comparative material representing *brasiliensis*. Subspecies of *brasiliensis* have been described as ranging into the eastern Andes from Peru to Colombia but I feel certain that the two new forms under consideration can have little in common with them, because the Ecuador material is all from the western Andes.

***Sylvilagus kelloggi*, new species**

FIG. 3, C and E

TYPE.—No. 60515, Amer. Mus. Nat. Hist.; ♂ ad.; Guachanamá, Provincia de Loja, 9050 feet, Ecuador; October 8, 1920; collector, H. E. Anthony. The type is a skin and skull, both in good condition.

GENERAL CHARACTERS.—A good-sized species, with contrasted head markings and whitish underparts.

DESCRIPTION.—

Color above, grizzled cream-buff and black, the individual hairs tricolored, being plumbeous black at base, banded with about five millimeters of cream-buff and tipped with black; black heaviest along the back, sides clearer; crown, from nose to base of ears, cinnamon ticked with black; patch at nostrils and narrow superciliary band cream-buff; cheeks like sides, heavily lined with black; nape, clear cinnamon, extending about as far as the laid-back ears; ears, externally, hister; hands and feet, above,

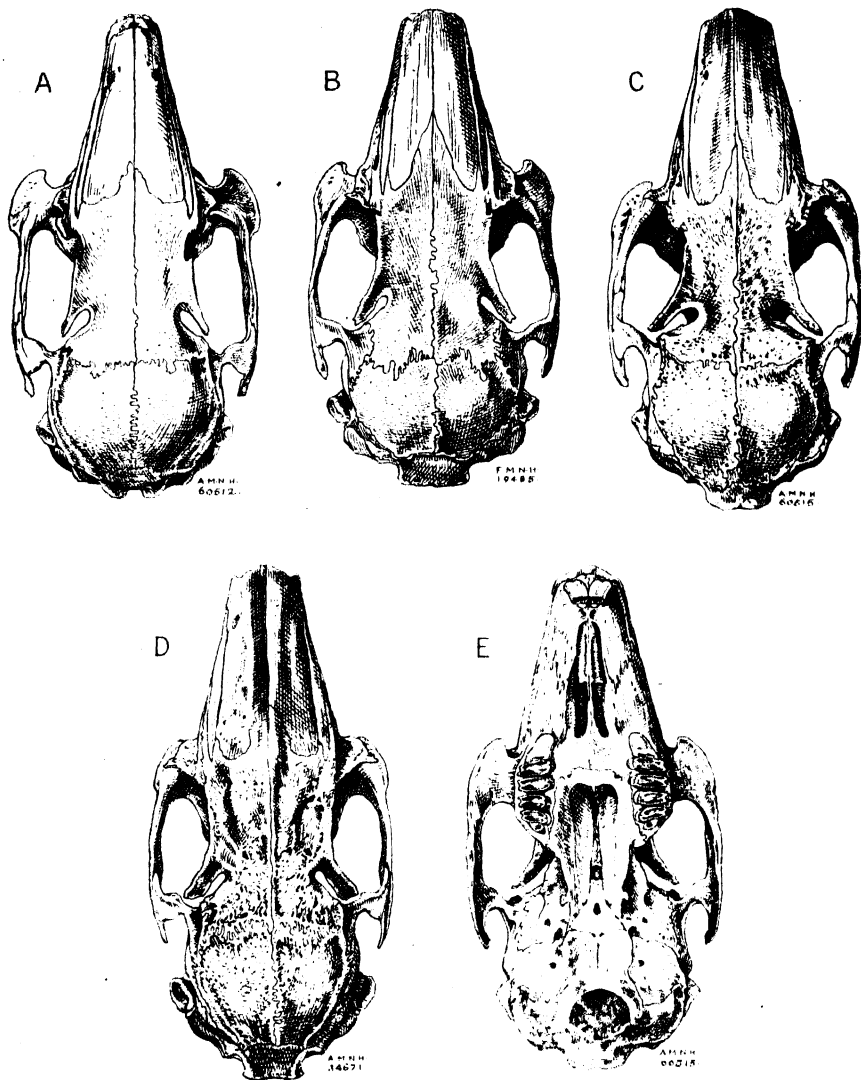


Fig. 3. Skulls of *Sylvilagus*

- A. *Sylvilagus andinus canarius*, Taraguacocha, Ecuador.
- B. *Sylvilagus defilippi*, Myobamba, Peru.
- C, E. *Sylvilagus kelloggi*, type.
- D. *Sylvilagus daulensis*, type.

Figures natural size.

between cinnamon and cinnamon-buff; underparts practically clear white; throat patch cinnamon-buff; tail small and inconspicuous.

Skull moderately convex from parietals to end of nasals; nasals bowed distally; postorbital process on frontal long, slender and almost coalesced with short process from frontal and parietal; anteriorly the supraorbital margin of the frontal is practically entire, with only a very shallow notch; auditory bullæ normal, moderately inflated.

MEASUREMENTS.—Taken in the flesh: total length, 355 mm.; tail vertebrae, 25; hind foot, 82. Skull, greatest length, 67.1; length of nasals, 28.2; zygomatic breadth, 33; interorbital breadth, 13.2; breadth of braincase, 24.2; length of incisive foramina, 16.5; breadth of palatal bridge, 6.5; alveolar length of upper molar series, 12.5.

Besides the type, two other specimens were shot at Guachanamá on the same day, all three specimens agreeing quite well in coloration, the variable features being the amount of black on the back and the clearness of the white underparts, the general average of the light-colored underparts being nearer ivory-yellow than pure white. This species was also taken at El Paso, Provincia del Azuay, elevation about 8500–9000 feet.

Sylvilagus kelloggi may be easily distinguished from any other Ecuadorean *Sylvilagus* by its general color pattern, by the well-developed postorbital processes (in one of the Guachanamá series the postorbital process on the right has coalesced with a process coming off the fronto-parietal suture) and by the absence of a deep notch in the anterior border of the frontal. Skulls of *kelloggi* present a deeply pitted area along the posterior half, on the frontal, parietal, interparietal and occipital elements, a condition which appears to be not at all so noticeable in skulls of *andinus*, absent in *defilippi*, but well developed in *daulensis* (see Fig. 3).

Sylvilagus defilippi, described from Quijos, Ecuador, ranges along the eastern slope of the eastern Andes and could not possibly be identical with any *Sylvilagus* along the western Andes. A specimen identified by Dr. W. H. Osgood as *defilippi* and taken at Myobamba, Peru, has been kindly loaned to me for comparison (Fig. 3, B). While obviously distinct from *kelloggi*, notably in the characters of smooth, unpitted braincase, and less well-developed postorbital processes, there is however enough resemblance to cause me to believe that possibly the two forms are local representatives of a well-marked group analogous to the *andinus* group.

This handsome species is named for Mr. L. O. Kellogg, of the South American Development Company, Portovelo, Ecuador. Mr. Kellogg has displayed a keen interest in the work of the American Museum in

Ecuador, and during 1920 and 1921, when Portovelo was the headquarters for a museum expedition, he assisted in numerous helpful and thoughtful ways.

***Sylvilagus chillæ*, new species**

TYPE.—No. 60511, Amer. Mus. Nat. Hist.; ♀ ad.; trail from Salvias to Zaraguro, 6600 feet, Provincia del Oro, Cordillera de Chilla. Ecuador; August 29, 1920; collector, H. E. Anthony. The type is a skin and skull, the skin in good condition but the skull badly shattered and presenting only the superior elements in condition for comparison.

GENERAL CHARACTERS.—Very similar to *kelloggi* but much darker above and with broader frontal region.

DESCRIPTION.—

Color above predominately black, the hairs tricolored, plumbeous black at base, banded with warm buff, tipped with black; sides and flanks only slightly lighter in appearance than back; crown, from nose to base of ears, tawny sprinkled with black; nuchal patch small, tawny; conspicuous nostril patches, spot in front of eye, and spot just above and behind eye, between cream-color and cream-buff; cheeks, cream-buff densely sprinkled with black; ears bister; upper surfaces of hands and feet, between cinnamon and cinnamon-buff; color, below, ivory-yellow to pinkish buff; throat patch, cinnamon-buff.

Skull essentially like that of *kelloggi* but with very broad interorbital region, short, broad nasals, flat profile from parietals to end of nasals, margin of frontal continuous anteriorly to lacrymal without any conspicuous supraorbital notch.

MEASUREMENTS.—Taken in the flesh: total length, 382 mm.; hind foot, 81. Skull, length of nasals, 25.7; zygomatic breadth, 34; interorbital breadth, 16.3; alveolar length of upper molar series, 14.

Sylvilagus chillæ is a forest-dwelling form and was taken in the subtropical jungle along the southwestern flank of the Cordillera de Chilla. This forest lies in a belt of heavy rainfall and it is doubtless due to this fact that *chillæ* is such a dark, richly colored form. It may be immediately distinguished from the other rabbits of the Ecuadorean Andes by its superficial appearance, and its skull characters bear out the distinction. The closest relative of *chillæ* would appear to be *kelloggi*, and more abundant material may bring to light intergrades which will necessitate making *chillæ* a subspecies of *kelloggi*. Geographically, the facts hint strongly that *kelloggi* may represent, in the temperate, more depauperate forest, the same full species of which *chillæ* may be the representative in the subtropical, heavy forest. On the basis of the material available, the gap between *chillæ* and *kelloggi* seems, however, to be rather too great to allow such a linking up of the two forms.

The type and topotype of *chillæ* were shot at night, under the jacklight, when they came out of the heavy vegetation to feed about

the edges of a small clearing or "llano." Because of the dense cover in which these rabbits live, it would be almost impossible to shoot one under ordinary circumstances during the day.

***Lonchorhina occidentalis*, new species**

Fig. 4, B, natural size

TYPE.—No. 62101, Amer. Mus. Nat. Hist.; ♂ ad.; Puente de Chimbo, Provincia del Guayas, Ecuador, altitude 1200 feet; September 7, 1922; collector, G. H. H. Tate. The type is a skin and skull, both in fair condition.

GENERAL CHARACTERS.—A large-eared bat, with very tall tragus, wide interfemoral membrane and conspicuous whitish blotches on tips of wings.

DESCRIPTION.—

Color of fur above, uniform chestnut-brown; below cinnamon-brown; all membranes blackish, with the exception of irregular blotches of ivory-yellow on posterior margin of wings near tips, and, less extensively, on more proximal portions of wing margin.

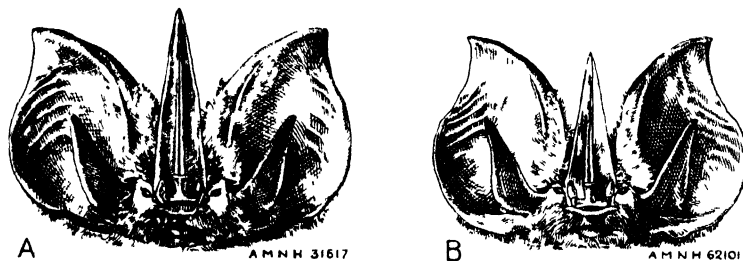


Fig. 4. Face and head of *Lonchorhina*.

A. *Lonchorhina aurita*, San Esteban, Venezuela
B. *Lonchorhina occidentalis*, type

Ears very large and broad but not as tall as in *Lonchorhina aurita*; five transverse plications on posterior half of ear conch; tragus very tall and slender; nose-leaf, while not as tall as in *aurita*, very high and reaching almost to tips of ears, sparsely haired basally.

Wings large and broad, naked everywhere, but fur of body extending along forearm about midway; interfemoral membrane very extensive and supported by well-developed calcaria and long tail which extends to extreme tip of membrane.

Skull normal for the genus and very similar to that of *aurita*.

MEASUREMENTS.—Taken in the flesh: total length, 110 mm.; tail vertebrae, 51; hind foot, 15; taken from the dry skin; length of forearm, 48.7 (*aurita*, three specimens, 51.7, 51.3, 50.9); height of ear from notch, 25.5 (*aurita*, 29.3); height of tragus, 11.6 (14.4); height of nose-leaf, 18.2 (21.7). Skull, greatest length, 20; zygomatic breadth, 11; mastoid breadth, 10.4; interorbital breadth, 4.8; length upper toothrow, C-M³, 6.8.

As far as I can ascertain, only one species of *Lonchorhina* has been described, *Lonchorhina aurita*. The geographical range of this form, as known, is the West Indies and the northern corner of South America.

Specimens are rare in collections. Fortunately, the American Museum has a series of three collected by Mr. Carriker at San Esteban, Venezuela. These three specimens all agree in quite uniform coloration, show no traces of whitish wing-markings, and have the nose-leaf equal to or slightly exceeding the ears in height (Fig. 4, A).

The *Lonchorhina* here described displays all of the well-marked characters which distinguish the genus and superficially appears to be very similar to *aurita*. The whitish wing-blotching, which is the most immediate external character of separation, does not have the appearance of being an individual or fortuitous marking because both wings are blotched in the same area, although not closely symmetrical. However, the specific identity of *occidentalis* does not rest entirely upon the wing markings, and the additional characters of shorter nose-leaf, lower ears, slightly shorter forearm, and blacker ears and wing membranes demonstrate the presence in Ecuador of a hitherto unknown species of *Lonchorhina*. Probably *occidentalis* is the western representative of the genus and the specific name is based upon this assumption.

59.82(67.5)

NOTES ON SOME BIRDS OF TROPICAL AFRICA, WITH
DESCRIPTIONS OF THREE NEW FORMS¹

BY JAMES P. CHAPIN

THE SUBSPECIES OF THE NARINA TROGON

Apaloderma æquatoriale Sharpe, though repudiated by its own sponsor, has proved to be a species distinct from the Narina trogon of South Africa. My examination of Dr. Sharpe's type in the British Museum reveals that my *A. minus*² is a synonym of *æquatoriale*, earlier described from the forests of the Cameroon. Differences in our methods of measuring the wing led me to believe that *minus* had a shorter wing;

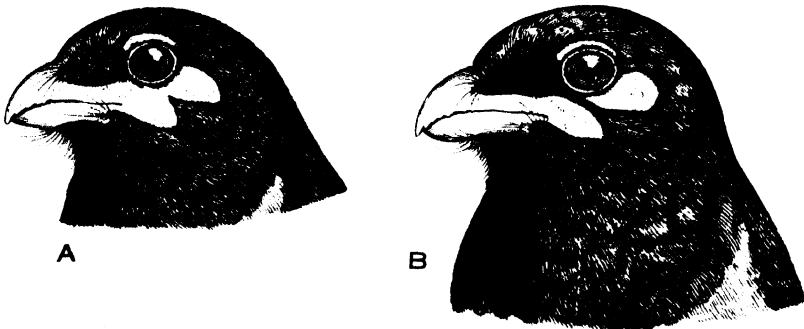


Fig. 1. Heads of two African Trogons, to show extent of bare cheek patches.

A, *Apaloderma æquatoriale*, adult male, from Ituri district. B, *A. narina brachyurum*, adult male, from Ituri district. From sketches of freshly killed examples, by the author. Three-fourths natural size.

but I now find that *æquatoriale* ranges from the Southern Cameroon eastward to the Ituri, with so little difference in size that not even a subspecific distinction is tenable. One of its salient characters has not yet been placed on record. The narrow line of green feathers which in *A. narina* crosses the cheeks, from lores to ear-coverts, and separates the two patches of bare green skin, is interrupted in *æquatoriale* so that the two bare patches—here yellow—are confluent. We thus have a ready means of distinguishing the two species.

¹Scientific Results of the American Museum Congo Expedition. Ornithology, No. 8.

²1915, Bull. Amer. Mus. Nat. Hist., XXXIV, p. 510.

When describing *minus* I called attention to the small size of representatives of *Apaloderma narina* in the Ituri Forest, and also (on page 510) to the gray breast of females of the latter species. The longer-tailed *narina* of South Africa and many other parts of the continent has in the adult female a cinnamon color on the breast and lores which is not very different from that in *æquatoriale*. Dr. V. G. L. van Someren has recently mentioned the grayer breasts of Uganda specimens,¹ as compared with typical females from South Africa; and now that I have gone over the series in many museums of Europe and America, I am able to show that the typical form of *Apaloderma narina* is a bird of woods and gallery forests in the savanna districts of East and South Africa. *A. narina constantia* is its representative race in Upper Guinea; and, although the rain forest of Lower Guinea is largely occupied by *A. æquatoriale*, it harbors also a short-tailed race of *narina*, with a gray breast in the female. The latter ranges from Southern Cameroon east to the Budongo Forest in Uganda.

The forest race of *narina* is therefore the form which still needs a name. Before proposing a new one, we must assure ourselves that *A. rufiventre* of Dubois² does not apply. His type was an adult male from "Tanganyika, 1884," collected by Storms, which fortunately is still preserved in the Brussels Museum. The dull reddish coloration for which it was named I found to have completely disappeared, so that the specimen looks like any old bleached skin of *narina*, save that the green of the upper back had been turned bronze, as though by some liquid. As Dubois stated, the line of feathers across the cheek is complete. According to my measurements the wing (straightened) measures 135 mm., the tail, 175; and, because of the length of tail especially, I assign it to *Apaloderma narina narina*. The dimensions given by Dubois are: wing, 132; tail, 170. A female specimen, also taken by Storms near Tanganyika, has a wing of 134 mm. and tail of 178.

For purposes of comparison I add a table of measurements which shows the size relations of the various forms of the present genus of trogons.

¹1922, *Novitates Zoologicae*, XXIX, p. 72.

²1896, *Proc. Zool. Soc. London*, p. 999.

		Of wing (straightened)	TAIL
<i>Apaloderma narina narina</i>	35 males	129-145	160-200
<i>Apaloderma narina narina</i>	7 females	128-144	164-195
<i>Apaloderma narina constantia</i>	2 males	126-133	163-164
<i>Apaloderma narina brachyurum</i>	19 males	122-136	146-166
<i>Apaloderma narina brachyurum</i>	11 females	122-136	149-170
<i>Apaloderma æquatoriale</i>	27 males	115-126	136-161
<i>Apaloderma æquatoriale</i>	7 females	110-125	140-156

The average differences in measurements are well marked, but overlapping is considerable. With further aid from the color characters, almost every specimen of *narina* can be definitely referred to its proper subspecies. The interrupted feathering of the cheeks always betrays *Apaloderma æquatoriale*.

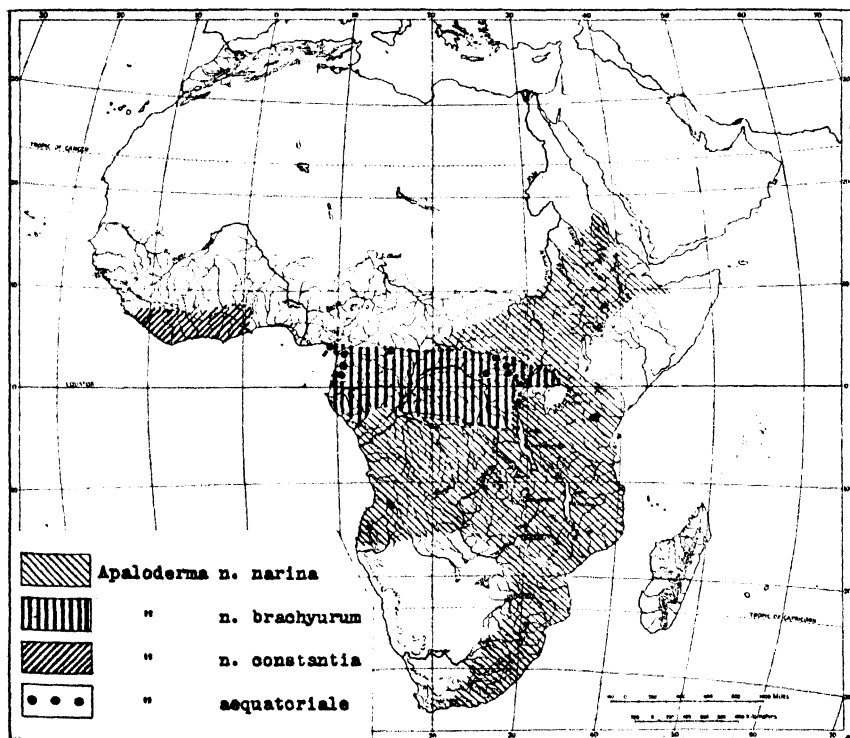


Fig. 2. Map of Africa, showing the ranges of all forms of *Apaloderma*.

Localities from which *A. æquatoriale* is known are indicated by dots; but its range is doubtless continuous, though a little more restricted than that of *A. n. brachyurum*.

***Apaloderma narina brachyurum*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *A. narina narina* of southern Africa, but the wing averaging 8 mm. shorter, and the tail 23 mm. shorter. The adult female differs also from that sex of typical *narina* in having the chest and lores not washed with cinnamon, but clear gray with distinct metallic green reflections at the sides. Though agreeing more closely in size with *A. n. constantia*, the male of the present form differs in having the wing-coverts and secondaries of a darker color, the whitish vermiculations fewer and finer.

TYPE.—♂ adult, No. 158881, Amer. Mus. Nat. Hist.; Avakubi, Ituri District, Belgian Congo, September 27, 1913 (Lang and Chapin).

MEASUREMENTS OF THE TYPE.—Wing (straightened), 125 mm.; wing (chord), 120; tail, 148; exposed culmen, 17.5; metatarsus, 14.

DISTRIBUTION.—From the coast of Southern Cameroon and Spanish Guinea through the rain forest of the Congo basin to the Upper Ituri, occurring also in the heavier forests of Uganda (the Budongo Forest, for example) and eastward to Chagwe.

SPECIMENS EXAMINED.—Cameroon: Efulen, 1; Bipindi, 1. Spanish Guinea: Asseng, 1. Belgian Congo: Banalia, 1; Avakubi, 11; Gamangui, 3; Bafwabaka, 2; Pawa, 1; Medje, 1; Poko, 2; Ituri Forest near Kilo, 1; Forest north of Beni, 1. Uganda: Budongo Forest, 5; Kwa Kitola, 1.

**SWALLOWS OF THE GENUS *PSALIDOPROCNE* IN THE
NORTHEASTERN CONGO**

In the forested parts of the Ituri and southern Uelle districts we found not only the eastern race of the short-tailed species, *Psalidoprocne nitens centralis* Neumann, but two other species with deeply forked tails, one having dark gray under wing-coverts, the other white ones. The two latter seem to occupy separate but adjacent territories, for the one darker beneath the wings was found at Avakubi and westward through the forest area at least as far as Stanleyville and the lower Aruwimi River. At Medje, a post which occupies a clearing near the northern edge of the Ituri Forest, its place is taken by the species with white beneath the wing, the latter extending out into the savannas of the Uelle drainage at least to Niangara, Nzoro, and Faradje. On the White Nile it must in turn be replaced by *P. albiceps*, which alone has been taken in the Lado Enclave. To the northward in the Bahr-el-Ghazal Province no species of the genus has as yet been reported.

The long-tailed *Psalidoprocne* of Avakubi, with dark-gray axillary plumage, has already been referred to *P. bamingui* Alexander by Bannerman,¹ who had specimens collected by Dr. C. Christy. That these birds of the Ituri do agree rather closely with Alexander's type I have con-

¹1920, *Revue Zool. Africaine*, VII, p. 291.

vinced myself; but the agreement extends even farther, to the type of *P. chalybea* Reichenow, from Victoria, Cameroon, which I have compared with one of our specimens. Though realizing what small differences in the tone of the gloss of the plumage, in the color of the under wing-coverts, or in the shape of the tail, may be of importance in this genus, I prefer to call all these specimens, from the western Cameroon to the Ituri, *P. chalybea* Reichenow. It may be added that in the broad area separating the Bamingui River and the Aruwimi, two adults of *chalybea*, identified by Professor Reichenow, were collected by Schubotz at Yakoma (on the upper Ubangi River) and are now in the Frankfort Museum,

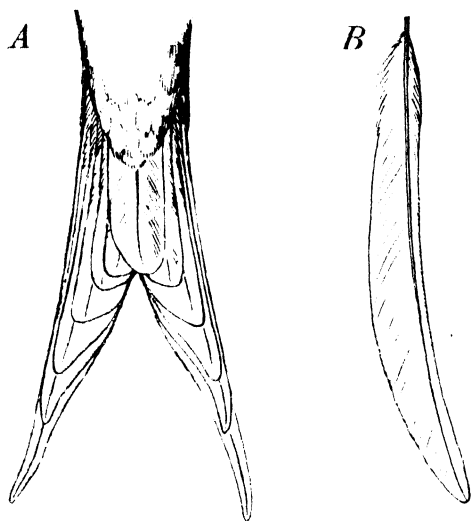


Fig. 3. Differences in the tails of two species of *Psalidoprocne*.

A, Tail of *P. mangbettorum* (adult male, type specimen) seen from above. B, Right outermost tail-feather of *P. oleaginea* (drawn from the type, an adult male, in the Museum of Lord Rothschild at Tring). Both figures three-fourths natural size.

where I have examined them. According to Professor Reichenow,¹ the species also ranges westward to Liberia. He had compared an adult bird from Sekondi (Gold Coast) with his type, but I feel uncertain as to the Liberian record.

Even greater difficulty was experienced in naming the species from the Uelle with white axillaries, for its nearest ally has proved to be *P. oleaginea* Neumann,² which Professor Reichenow swept inconsiderately into the synonymy of *P. petiti orientalis*.³ Since examining the type and

¹1903, 'Die Vögel Afrikas,' II, p. 428.

²1904, Orn. Monatsber., XII, p. 144 (Kaffa, in S. Abyssinia).

³1905, 'Die Vögel Afrikas,' III, p. 829.

two other males of *oleaginea* in the museum at Tring I am convinced of their distinctness from *orientalis*, because of differences in body color and the shape of the outer rectrices. I should not regard *oleaginea* as a subspecies of *orientalis*, though its describer did; nor would I follow Professor Reichenow in calling *orientalis* a race of *petiti*. Many of these saw-winged swallows, despite their slight characters, seem to be stable forms and worthy of binomial designation as long as actual intergradation cannot be proved.

With regard to *P. blanfordi* Blundell and Lovat,¹ from Southern Abyssinia, Neumann had seen the type in London² before describing *oleaginea* as new. He thought that *blanfordi* would not prove separable from *pristoptera*.

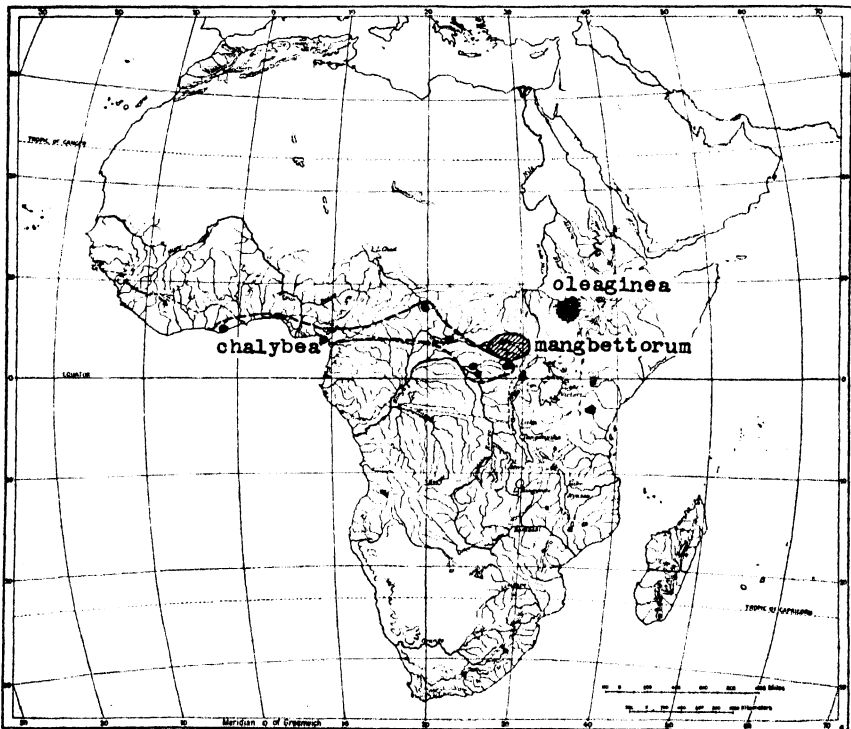


Fig. 4. Map to illustrate the ranges of three species of *Psalidoprocne*: *chalybea*, *mangbettorum*, and *oleaginea*, as known at present.

¹1899, Bull. British Orn. Club, No. LXVI, November.

²1905, Journal f. Orn., LIII, p. 203.

Psalidoprocne orientalis Reichenow of East Africa differs from the allied species of the Uelle in having both wings and tail longer, the green gloss of the body plumage duller, and the under wing-coverts grayer in places. *P. oleaginea* Neumann is closer, but still differs in that the oily-green gloss of its body is slightly browner, when viewed in a good light. Its wings are longer, the outermost rectrices taper less, or are broader toward the tip; but the best distinction of all is seen in the under wing-coverts. The "axillaries" and under wing-coverts are white in *oleaginea*, with the exception of the greater under primary-coverts, which are almost wholly fuscous. These, the longest of the under wing-coverts, are white like the others in the bird of the Uelle, which I propose to name as follows.

***Psalidoprocne mangbettorum*, new species¹**

TYPE.—♂ adult, No. 159746, Amer. Mus. Nat. Hist.; Medje, Ituri district, Belgian Congo, March 20, 1910 (Lang and Chapin).

DESCRIPTION OF TYPE.—Head and body, above and below, black with a rich oily-green gloss. Quills of wings and tail similar but with less luster. Under wing-coverts entirely pure white, including the lengthened marginal coverts commonly termed "axillaries." Outermost primary in this sex has of course a pronounced saw edge; and the tail is deeply forked, with broad middle feathers, the long outermost ones tapering narrowly at the tip.

MEASUREMENTS OF THE TYPE.—Wing, 97 mm.; tail, 89 (middle pair of rectrices 45); exposed culmen, 5; metatarsus, 9.5. Four other males measure as follows: wing, 97.5–100.5; tails, 85–92.5 (middle feathers 43–46).

DISTRIBUTION.—Extends, so far as known, from the neighborhood of the Nepoko River northward and northeastward to the Congo-Nile divide, possibly a little way into the Bahr-el-Ghazal.

THE LARGEST SUBSPECIES OF *PYRENESTES OSTRINUS*

Professor Neumann,² Mr. Bannerman,³ and other writers, have applied the name *ostrinus* Vieillot to the largest form of this extremely variable weaver-finch, such as occurs in Northern Nigeria. Vieillot's type, however, is still preserved in the Paris Museum of Natural History, where Monsieur J. Berlioz kindly showed it to me. It is not so large a bird, but resembles more closely in dimensions the specimens from the Eastern Ituri district which Neumann⁴ referred to *P. o. centralis*. My measurements of the type of *ostrinus* (an adult male) are: wing, 64 mm.; tail, 48; bill (from nostril), 10; width of lower mandible at base, 15;

¹From the Mangbetu tribo, inhabiting a part of the same country.

²1910, Journ. f. Orn., LVIII, p. 527.

³1922, Rev. Zool. Africaine, IX, p. 308.

⁴1910, Journ. f. Orn., LVIII, p. 529.

metatarsus, 20. It is labelled "Afrique Occidentale," and came presumably from either Lower Nigeria or the Gaboon Coast, in both of which places individuals of similar size have since been collected.

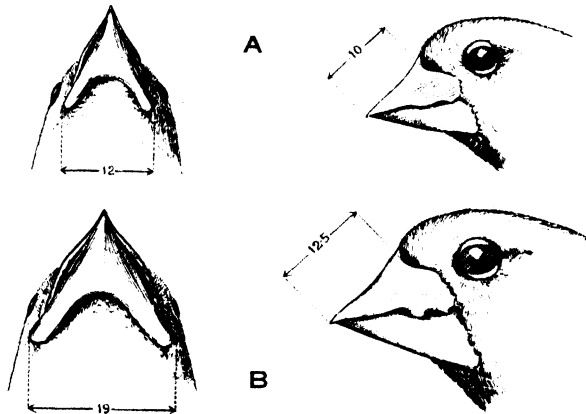


Fig. 5. Beaks of the large and small races of *Pyrenestes ostrinus*, to show the degree of difference in size, as well as the method of measuring.

A, *P. o. rothschildi*, adult male from Avakubi, Ituri District, Belgian Congo. B, *P. o. maximus*, adult male from Faradje, Upper Uelle District. Natural size.

The larger form, with the mandible from 17.5 to 20 mm. wide, besides inhabiting Northern Nigeria, has been collected by Dr. V. G. L. van Someren in parts of Uganda, and by the Congo Expedition of the American Museum at Faradje in the Upper Uelle district and at Stanleyville on the Upper Congo. It apparently lacks a subspecific name, and I therefore designate it as follows.

***Pyrenestes ostrinus maximus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Like *P. ostrinus ostrinus* Vieillot, but both sexes much larger, the beak especially far stouter.

TYPE.—♂ adult, No. 162176, Amer. Mus. Nat. Hist.; Faradje, Upper Uelle District, Belgian Congo, April 14, 1911 (Lang and Chapin).

DESCRIPTION OF TYPE.—Coloration the same as in the typical race: body mostly black, with head, chest, and stripes down sides of breast bright scarlet; upper tail-coverts of same color, and upper surface of tail darker red. Under tail-coverts faintly spotted with red, but mostly black. Wing, 73 mm.; tail, 55.5; bill (from nostril), 12; width of mandible at base, 20.1; metatarsus, 22.5.

A paper dealing in full with all the species and races of the genus *Pyrenestes*, and their distribution, has been submitted to the Editor of the Bulletin of the American Museum of Natural History for publication in a forthcoming volume.

59.7.5(67.2)

NEW AFRICAN FISHES

BY JOHN TREADWELL NICHOLS

Following the publication of its Bulletin on Congo fishes, Monsieur A. Baudon kindly sent this Museum some small fresh-water fishes from French Equatorial Africa, which are interesting to compare with the large collections brought back by The American Museum of Natural History Congo Expedition a few years ago. Among them are three previously undescribed species as follows.

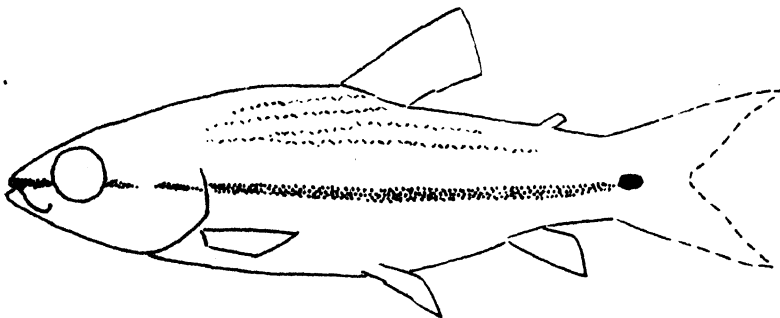


Fig. 1. *Nannathiops angustolinea*. 19 mm. to base of caudal.

***Nannathiops angustolinea*, new species**

The type, No. 8106 American Museum of Natural History, from Fort Crampel, Gribingui, West Africa, August 1919, measures 19 mm. to base of caudal. Depth, 3.2 in this (standard) length; head, 3.0. Eye, 3.5 in head; snout, 4.0; maxillary, 3.7; interorbital, 3.2; depth of caudal peduncle, 2.3. Dorsal origin equidistant between base of caudal and front of pupil; pectorals reach $\frac{3}{8}$ distance to ventrals; ventrals $\frac{2}{3}$ distance to anal; caudal forked. Dorsal with 11, anal with 9 rays. Adipose small but well developed. Scales ciliate, 33. The 7 front ones with tubes; 11 rows between dorsal and ventral. A bold dark stripe from snout to base of caudal where it ends in a conspicuous, longitudinally oval black spot. Several faint, narrow dark streaks higher up on the side between the rows of scales, about 4 below the dorsal.

Besides the type, 2 specimens, 17 and 20 mm. long, have the same data.

In this little fish the dorsal origin is more posterior than in related species of the genera *Nannathiops* and *Neolebias*, and its color pattern, usually diagnostic in these species, is somewhat different from that of those described.

***Barilius engrauloides*, new species**

The type, our only specimen, No. 8107 American Museum of Natural History, from the Ubangui River at Bangui, West Africa, July 1919, is 67 mm. long to base of caudal. Depth, 4.0 in this (standard) length; head, 3.6. Eye, 3.4 in head; snout, 3.4; maxillary, 2.2; interorbital, 4.6; least depth of peduncle, 2.7; longest dorsal ray, 2.5; longest anal ray, 1.8; pectoral, 1.0; ventral, 1.6. Dorsal with 9

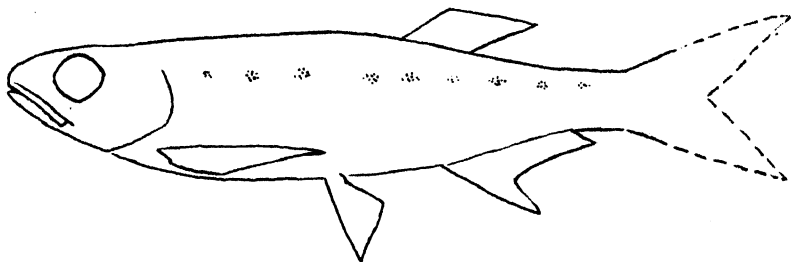


Fig. 2. *Barilius engrauloides*. 67 mm. to base of caudal.

rays; anal with 10. The dorsal origin is a little nearer the base of caudal than posterior margin of opercle; pectoral just reaches ventral, which extends $\frac{2}{3}$ the distance to anal; anal origin under center of dorsal. The jaws are equal, ventral outline slightly more convex than dorsal. Lateral line complete, 37; 6 rows of scales between lateral line and dorsal, 2 between same and ventrals; 12 around caudal peduncle.

Color in alcohol pale, an irregular row of 11 dark dots along the side on a level with the eye.

This fish has the dorsal origin very far back for a *Barilius*. It seems to be more or less intermediate between species of that genus and of *Engraulicypris*.

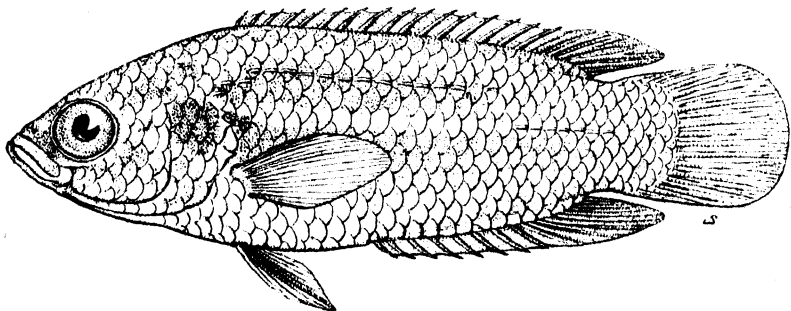


Fig. 3. *Anabas lineatus*, type. 37 mm. to base of caudal.

***Anabas lineatus*, new species**

The type, our only specimen, No. 8108 American Museum of Natural History, from French Equatorial Africa, is 37 mm. long to base of caudal. Depth, contained

0 in this (standard) length; head, 2.9. Eye, 3.6 in head; maxillary, 3.3; interorbital, 4.0; least depth of peduncle, 2.2; longest dorsal spine, 4.0; longest dorsal ray, 2.0; pectoral, 1.6; ventral (which is pointed and just does not reach anal origin), 2.0; longest anal spine, 4.5; longest anal ray, 1.8. Head bluntly pointed, the greatest depth of the body at the origin of the ventrals, peduncle short and distinct. The only serrulations about the head 4 or 5 small teeth on the edge of the opercle opposite the base of the pectoral. Dorsal XVI, 7; anal VIII, 10. Scales 27; 12 cross-series between dorsal and ventrals. Ground color in alcohol pale, darker along the back, two longitudinal parallel dark shades separated by a narrow pale line along the sides, ventrals and vertical fins more or less blackish.

Differs most strikingly from *A. nanus* in color, that species having bold dark crossbands.

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59.82(8)

DESCRIPTIONS OF PROPOSED NEW BIRDS FROM BRAZIL AND PARAGUAY

By GEORGE K. CHERRIE AND (MRS.) E. M. B. REICHENBERGER

This is the third preliminary report on the Roosevelt Collections made by Mr. Cherrie in the years 1913 and 1916. The authors are indebted to the authorities of the natural history museums of Munich, Frankfort, Berlin, Vienna, Tring, and South Kensington for affording Mrs. Reichenberger opportunity to study material in connection with the preparation of the present paper.

All measurements are given in millimeters and made with dividers, the wing retaining the curvature of its primaries as well as the bent position of the manus taken in drying.

Tangara cyaneicollis melanogaster, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Tangara cyaneicollis cæruleocephala* from northern and central Peru, but with very little if any bluish wash on lower flanks, the whole abdomen being nearly uniform black, whereas the rump is more or less conspicuously mixed with verditer blue.

TYPE.—No. 128220, Amer. Mus. Nat. Hist.; ♂ ad.; Utiarity near Salto Bello, Papagaio River, alt. 1500–2500 ft., Matto Grosso, Brazil; January 30, 1914; George K. Cherrie. Wing, 66; tail, 44.5; exposed culmen, 10.5.

SPECIMENS EXAMINED

Tangara cyaneicollis melanogaster.—BRAZIL: Matto Grosso,—Engenho do Gama, 4 ♂, 1 ♀, Utiarity, 1 ♂, 3 ♀, Tapirapoan, 1 ♂, 1 ♀, Doze Octubre, 1 ♀.

Tangara cyaneicollis cyaneicollis.—BOLIVIA (north): Yungas,—Songo, 1 ♂. PERU (southeast): Andes of Carabaya, Yahuar Mayo, 2 ♂; Chaquimayo, alt. 3000 ft., 2 ♂, 1 ♀; Rio Inambari, 3 ♂, 1 ♀; Santo Domingo, 3 ♂, 3 ♀; La Pampa, 1 ♂; Candamo, 2 ♂; Rio Javara, 3 ♂, 1 ♀.

Tangara cyaneicollis cæruleocephala.—PERU (north): Nuevo Loreto, eastern Tayabamba, 2 ♂; Pi'a, 1 ♀. PERU (central): Chanchamayo, alt. 3300–5000 ft., 1 ♂, 1 ♀, 1 ♀ juv.; Prov. Huanuco,—Pozuzo, 1 ♂. ECUADOR (east): Rio Napo, San José, 1 ♀ juv.; Zamora, 3 ♂, 3 ♀.

Tangara cyaneicollis granadensis.—COLOMBIA: Bogotá Collection, 3 ♂, 1 ♀; Cauca Valley, 1 ♂; La Candela, 1 ♀; Andalucia, 1 ♂; near San Agustín, 2 ♂, 2 ♀.

Tangara cyaneicollis hannahæ.—VENEZUELA (western): Tachira,—San Cristóbal, 3 ♂, 1 ♀; Mérida, 1? (Cassin's type, Academy of Natural Sciences, Philadelphia).

This interesting new race resembles *Tangara cyaneicollis cæruleocephala* in the possession of a strong indigo blue tinge on the middle of the

MEASUREMENTS (Extremes and Averages)

	Wing	Tail	Exposed Culmen	Collection
<i>Tangara cyaneicollis melanogaster</i>				
Brazil: Matto Grosso	6 ♂ 64.5-70. (66.5) ¹	44. -47.5 (44.9)	9.5-10.5 (10.)	Amer. Mus. Nat. Hist.
" "	6 ♀ 62.5-66.5 (64.1)	41. -46.5 (43.5)	10. -10.5 (10.3)	" " "
<i>Tangara cyaneicollis cyaneicollis</i>				
North Bolivia: Yungas, Songo	1 ♂ 69.5	46.5	10.	Munich Museum
South-east Peru	4 ♂ 67. -70. (68.5)	44. -47.5 (46.1)	10. -11. (10.5)	" "
" "	1 ♀ 67.	48.	10	" "
<i>Tangara cyaneicollis carulcocephala</i>				
Eastern Ecuador: Zamora	3 ♂ 67. -69. (67.6)	43.5-45.5 (44.3)	10. -11. (10.5)	Amer. Mus. Nat. Hist.
North Peru: Nuevo Loreto	1 ♂ 67.5	47.5	9.	Munich Museum
" "	1 ♂ 68.5	48.5	9.5	" "
Eastern Ecuador: Zamora	3 ♀ 65. -68.5 (66.6)	43. -44. (43.6)	9.5-10.5 (10.)	Amer. Mus. Nat. Hist.
Central Peru: Chanchamayo	1 ♀ 63.5	44.	8.5	" " "
<i>Tangara cyaneicollis granadensis</i>				
Colombia	7 ♂ 67. -70. (68.8)	44. -49. (47.)	8.5-11. (10.1)	Munich Museum
Colombia: La Candela	1 ♀ 67.	48.	9.5	" "
" Bogota Collection	1 ♀ 66.5	46.5	10.	" "
<i>Tangara cyaneicollis hannahae</i>				
Venezuela: San Cristobal	3 ♂ 65.5-67.5 (66.5)	46. -50. (48.)	9.5-10.5 (9.8)	Berlepsch
" "	1 ♀ 67.	46.5	10.5	" "
" Mérida (Cassin's type)	1 ♀ 65.	50.	8.5	Philadelphia Academy of Nat. Sci.

¹Averages given in parentheses.

throat, in the color of the upper part of the head, and in the decidedly golden shoulder patch. When compared with *Tangara cyaneicollis cyaneicollis*, the upper part of the head is of a darker tinge, slightly washed with purple about the forehead and across the nape. In *Tangara cyaneicollis cæruleocephala*, however, the whole of the lower breast and abdomen is mainly deep purplish blue, shading into azure blue on the flanks, whereas in the new race the entire belly is either wholly black or slight obsolete edges of dull blue show only on some of the feathers of the flanks and anal region, this being especially noticeable in males in first annual plumage and in females. In the absence of blue on the belly, *Tangara cyaneicollis melanogaster* recalls *Tangara cyaneicollis hannahæ*, from the mountains of Venezuela (Tachira to Carabobo). *T. c. hannahæ*, however, may immediately be recognized by the deeper velvety black of the under parts, the much clearer verditer blue crown, without a purplish tinge on forehead and neck; by the decidedly lighter, more bronzy or silvery greenish shoulder patch; and by the silver greenish rump without any bluish admixture.

Tangara cyaneicollis melanogaster seems to have a peculiarly restricted range, it being as yet known only from the western portion of Matto Grosso.

Eupsittula aurea major, new subspecies

SUBSPECIFIC CHARACTERS.—Indistinguishable in coloration from *Eupsittula aurea aurea* from various Brazilian localities but wing and tail longer.

TYPE.—No. 149401, Amer. Mus. Nat. Hist.; ♂ ad.; Puerto Pinasco, Rio Paraguay, Paraguay; October 20, 1916; George K. Cherrie. Wing, 159.5; tail, 142; exposed culmen, 20.5.

Because it seems desirable to have a specified type locality for *Eupsittula aurea aurea*, a bird of widespread range, we formally propose Bahia, eastern Brazil.

SPECIMENS EXAMINED

Eupsittula aurea major.—PARAGUAY: Puerto Pinasco, 1 ♂ (the type), 1 ♀; Concepcion, 1 ♂.

Eupsittula aurea aurea.—BRAZIL: Bahia, —2 ♂, 1 ♀; West Minas Geraes, —Agua Suja near Bagagem, 1 ♀, 1 ?; Matto Grosso, —Palmiras, 1 ♂, 1 ♀, Tapirapoan, 1 ♂, José Bonifacio, 1 ♂; Maranhão, —Miritiba, 1 ♂, 1 ♀; Isle of Marajó, —Cachoneira, 1 ♂, 1 ♀; Fazenda Ararý on the upper Rio Ararý, 1 ♂, 1 ♀; Tuyuyu, 1 ♂, 1 ♀; Natal, 1 ♀.

Measurements

		Wing	Tail	Culmen	Collection
<i>Eupsittula aurea aurea</i>					
Brazil: Bahia	♂	142.	132.5	18.5	Amer. Mus. Nat. Hist.
" "	♂	139.5	125.5	18.	Munich Museum
" "	♀	140.	¹	17.5	Amer. Mus. Nat. Hist.
" Minas Geraes, Agua Suja near Bagagem	♀	146.	145.5	17.5	Munich Museum
" Minas Geraes, Agua Suja near Bagagem	?	148.5	141.	18.	" "
" Matto Grosso, Palmiras	♂	139.5	123.	18.	Amer. Mus. Nat. Hist.
" " " "	♀	141.	126.	17.5	" " " "
" " " Tapirapoan	♂	141.5	125.5	18.5	" " " "
" " " José Boni- facio	♂	147.5	136.	16.	" " " "
" Maranhão, Miritiba	♂	139.	118.5	19.5	Munich Museum
" " " "	♀	145.5	126.5	20.	" " " "
Isle of Marajó, Cachoneira	♂	145.	135.5	20.	" "
" Fazenda Ararý	♂	148.	¹	21.5	" "
" Tuyuyu	♂	141.	128.5	19.5	" "
" " "	♀	142.5	134.5	20.	" "
" Fazenda Ararý	♀	143.	¹	20.	" "
" Cachoneira	♀	137.5	128.	22.	" "
" Natal	♀	138.	131.	19.	" "
<i>Eupsittula aurea major</i>					
Paraguay: Puerto Pinasco (the type)	♂	159.5	142.	20.5	Amer. Nat. Nat. Hist.
" Puerto Pinasco	♀	155.	142.	19.	" " " "
" Concepcion	♂	153.	137.5	18.5	Munich Museum

***Manacus manacus subpurus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Under tail coverts white as in *Manacus manacus purus*, but with the gray area on sides and flanks more extensive and deeper in color, corresponding to the gray sides and flanks of *Manacus manacus trinitatis*. There is also a faint grayish wash on breast and abdomen. The blackish area on the back is more extended than in *Manacus manacus purus*, and the gray color of rump and upper tail coverts is darker.

TYPE.—No. 127944, Amer. Mus. Nat. Hist.; 1 ♂; Tapirapoan, Siputuba River, Matto Grosso, Brazil; January 19, 1914; George K. Cherrie. Wing, 51; tail, 30.5; exposed culmen, 9.

¹Tail defective.

SPECIMENS EXAMINED

Species with White Under Tail Coverts

Manacus manacus subpurus.—BRAZIL: Matto Grosso,—Tapirapoan (type), 1 ♂, Mutum Cavallo, 1 ♂, Santa Isabel (Rio Preto; right bank of the Rio Madeira), 1 ♂, Engenho do Gama, 1 ♂, 1 ♀, S. Vicente, 1 ♀.

Manacus manacus purus.—BRAZIL: Santarem, 6 ♂; Baião, 2 ♂; Providencia, 1 ♂; Pará, 1 ♂; Pedreira near Pará, 1 ♂; Utinga near Pará, 2 ♂; Calama (Rio Machados), 1 ♂; Borba, 3 ♂; Maranhão,—Miritiba, 2 ♂.

Species with Gray Under Tail Coverts

Manacus manacus manacus.—FRENCH GUIANA: Cayenne, 1 ♂. BRITISH GUIANA: Demarara, 1 ?; Wismar, 4 ♂; Rockstone (Essequibo River), 3 ♂; Faro, 1 ♂; Monte Alegre, 1 ♂.

Manacus manacus trinitatis.—TRINIDAD: Princetown, 5 ♂.

Manacus manacus abditus.—COLOMBIA: Santa Marta, 11 ♂; Puerto Valdivia, 1 ♂; Malena, 1 ♂.

Manacus manacus gutturosus.—BRAZIL: Bahia,—7 ♂; São Paulo,—Fazenda Cayoá (Salto Grande, Rio Paranapanema), 1 ♂, Sebastião, 1 ♂; Espírito Santo,—Victoria, 2 ♂.

Manacus manacus flavolus.—COLOMBIA: Bogotá, 3 ♂; within 20 miles of Honda, 6 ♂; Chicoral, 5 ♂.

Manacus manacus leucochlamys.—ECUADOR: Coast of Manaví, 3 ♂; Esmeraldas, 6 ♂.

Manacus manacus bangsi.—COLOMBIA: Barbacoas, 4 ♂.

Manacus manacus interior.—VENEZUELA: Maripá, 5 ♂. COLOMBIA: Villaviciencio, 1 ♂ (type, A. M. N. H.); Bogotá Collection, 3 ♂. ECUADOR: Rio Napo, 1 ♂.

This new subspecies is intermediate geographically, as well as in its subspecific characters, between *Manacus manacus purus* (from Santarem, type locality, and the whole lower Amazon region) and *Manacus manacus gutturosus* (from southeastern Brazil). As far as we know, *Manacus manacus subpurus* is confined to the central portion of Brazil. On the upper parts our new subspecies resembles *Manacus manacus manacus* in the extent of the black area and in the gray color of the rump and tail. It differs, however, in having the nape unbarred. We may therefore conclude that *Manacus manacus subpurus* ranges from at least Calama, on the right bank of the Rio Madeira, down to western Matto Grosso, while specimens of *Manacus manacus purus* are found at Borba on the right bank of the lower Madeira, east to Maranhão.²

¹The three males from Borba, Rio Madeira, agree in their main characters with *Manacus manacus purus* but form the connecting link with *Manacus manacus manacus* by the slight grayish admixture of the under tail coverts.

²Specimens recorded by Miss Sneath (Cat. Aves Amaz., p. 370, 1914), from Boim, the left bank of the Tapajoz, must be examined before ascertaining to which race they are referable. Specimens from Pebas, Iquitos (Peru), belong to *Manacus manacus interior* Chapman.

***Nystalus maculatus pallidigula*, new subspecies**

SUBSPECIFIC CHARACTERS.—Agreeing with *Nystalus maculatus parvirostris* from Goyaz, in shortness of bill and tail, but differing in the considerably paler deep buff, instead of tawny color, of the throat and in having the breast and sides marked with longitudinal stripes instead of rounded "rhomboid" spots.

TYPE.—No. 127477, Amer. Mus. Nat. Hist.; ♂ ad.; Urucum, near Corumbá, Matto Grosso, Brazil; December 8, 1913; George K. Cherrie. Wing, 78.5; tail, 70; exposed culmen, 29.5; culmen from nostril, 24.

SPECIMENS EXAMINED

Nystalus maculatus pallidigula.—BRAZIL: Matto Grosso,—Chapada, 2 ♂, Urucum, 4 ♂, 3 ♀, Retiro, 2 ♂, Caiçara, 1 ♂.

Nystalus maculatus maculatus.—BRAZIL: Ceará,—Quixadá, 2 ♂, 3 ♀, Juá, 2 ♂ (the type, Field Museum), 3 ♀; Bahia,—(trade skins), 18 ♀, Lamarão, 3 ♂, Fazenda Taboa, Rio Preto, 1 ♀, Joazeiro, 1 ♂, S. Amaro, 1 ♂, 2 ♀, Alagócinhas, 1 ♀, Mata de S. Joan, 1 ♀; Piauí,—Therezina, 1 ♂; Pernambuco,—Recife, 1 ♀; Maranhão,—1 ♀, Miritiba, 1 ♂, 3 ♀; Marajó Island,—Pacoval, 2 ♀; Santarém, 11 ♂, 9 ♀. 2 ad ♀; Rio de Janeiro, 1 ♀.

Nystalus maculatus parvirostris.—BRAZIL: Goyaz,—Rio Araguaia, 2 ♂ (the type, Tring Museum), 2 ♀.

Nystalus maculatus striatipectus.—BOLIVIA: Dept. Mizque,—S. José, 1 ♀; Dept. Santa Cruz,—Valle Grande, 1 ♀, Samaipata, 1 ♀, Pampa de la Isla, 1 ♂, Santa Cruz de la Sierra, 2 ♂, Pampas de Taperas (20 leagues south of Santa Cruz), 1 ♀; Prov. del Sara,—1 ♂; Chiquitos,—Palmarito (Rio S. Julian), 2 ♀; Dept. de la Cordillero,—Guanaes, 1 ♀; Dept. Tarija,—Villa Montes (Pilcomayo River), 3 ♂; neither locality nor sex given, 2; Puerto Suarez, 1 ♂. ARGENTINA: Prov. of Jujuy,—Perico, 1 ♂, 1 ♀; Prov. of Salta,—Embarcación, 2 ♂, 6 ♀, Rosario de Lerma, 7 ♂, 4 ♀; Prov. Tucuman,—Sarmiento, 2 ♂; Prov. Santiago del Estero,—Suncho Corral, 1 ♂, 3 ♀; Prov. de Chaco,—Avia Terai (General Pinedo), 1 ♂, 1 ♀.

Nystalus maculatus pallidigula agrees with *Nystalus maculatus striatipectus* from Bolivia and northwest Argentina in the pale color of the throat, and the markings of the lower parts, but is much smaller, the bill especially being weaker. The range of this subspecies is confined to Matto Grosso.

None of the characters claimed by Mr. Cory for his proposed new race of *Nystalus maculatus nuchalis*¹ hold good. There is perhaps a slight difference in the coloration of the under parts, the birds from Ceará being, as a rule, less heavily spotted beneath. This, however, may be due in part at least to the make-up of the skins, and is not borne out by the other specimens from northeast Brazil we have seen, since examples from Miritiba, Maranhão and the neighboring states of Piauí are not distinguishable from the average Bahia birds.

¹1919, Field Mus. Nat. Hist. Pub., No. 203, Zool. Series, XIII, Part II, No. 2, p. 398.

MEASUREMENTS (Extremes and Averages)

	Wing	Tail	Exposed Culmen	Collection
<i>Manacus manacus subpurus</i>				
Brazil: Matto Grosso	49. -51 (49.8)	30.5-31.5 (30.8)	9. -10.5 (9.6)	1
" Borba, Rio Madeira	49. -50 (49.1)	29. -31.5 (30.)	8.5-10. (9.1)	Vienna Museum
<i>Manacus manacus purus</i>				
Brazil: Santarem	47. -52 (49.5)	29. -31 (30.)	8.5-10. (8.9)	Amer. Mus. Nat. Hist.
" Providencia	49.	29.	8.5	" "
" Baião, Rio Tocantins	51.	32.	9.5	" "
" "	49.	30.	8.5	" "
" Diamantina, near Santarem	48.	30.5	9.5	" "

¹² ♂ from the Amer. Mus. Nat. Hist., 1 ♂ from the Vienna Museum.

Nystalus maculatus maculatus inhabits northeastern Brazil from Bahia to Ceará, Maranhão, and occurs also on the Island of Marajó and at Santarem.

Nystalus maculatus parvirostris is as yet only known from the Upper Rio Araguaya, near Leopoldina in the state of Goyaz.

Nystalus maculatus pallidigula is confined to west and east Matto Grosso.

Nystalus maculatus striatipectus ranges over eastern Boliwia and northwest Argentina.

59.57,66(729)

TWO NEW SPECIES OF WEST INDIAN CLERIDÆ
(COLEOPTERA)

BY A. B. WOLCOTT

Field Museum of Natural History, Chicago, Ill.

Through the kindness of The American Museum of Natural History, the writer has had the privilege of examining and describing the following interesting, new clerids.

Callotillus crusos, new species

Figure 1

Moderately slender; black. Dorsal surface rather feebly shining; ventral surface very shining; front of head narrowly rutilous; antennae (apical two segments black) and labrum at sides testaceous; elytra black, apical half in large part pale yellow, a large, ovate, ante-apical, common maculation, black, sides at middle with an oblique, elevated, white maculation, a similar minute, slightly transverse maculation at basal fourth at middle of width of each elytron.

Head, including the not prominent eyes, equal in width to pronotum at apex; surface rather coarsely rugoso-punctate; pubescence dense, semirecumbent, grayish white. Antennae slightly longer than head and prothorax, ten-segmented; basal segment short, very stout; second small, subtriangular; third to ninth triangular, their apices acute; ninth and tenth forming an elongate ovate mass; tenth narrower than eighth, nearly as long as seventh and eighth together; color testaceous; ninth and tenth segments black, the former narrowly testaceous at base.

Pronotum slightly longer than wide; apical margin truncate; sides parallel to slightly behind the middle, then rather strongly arcuately narrowing to about basal fourth, thence subparallel to base; base truncate, the extreme edge with a fine elevated margin; subapical constriction wanting; subapical transverse impression nearly obsolete, only faintly indicated in certain lights; surface with sculpture same as that of head; pubescence same as that of head but with long, sparse, erect, black hairs intermixed. Elytra at base nearly twice as wide as pronotum at base; length two and one-third times width at base; humeri obtusely rounded; sides from humeri to middle straight, nearly parallel, behind the middle gradually broadening to apical fourth, thence arcuately narrowing to the conjointly rounded apices; color black, apical half pale yellow, anterior margin of yellow portion convex; in apical third a large, elongate ovate, common, sutural maculation, extending very nearly to apical margin, black; sides slightly anterior to middle with a feebly arcuate, linear, elevated, white maculation, this extending obliquely and attenuately forward from lateral margin halfway to suture; at basal fourth a minute, slightly transverse, elevated, white maculation midway between the lateral margin and the suture; base with a broad triangular area having one angle on suture, and an oblique fascia each side.

extending from immediately behind the humeri to the suture at a point slightly before the middle, composed of dense, coarse, grayish-white pubescence; a large, feebly elevated, subbasal tubercle, midway between lateral margin and suture, densely clothed with a tuft of long, black hairs; black portions densely clothed with short, semirecumbent, black pubescence, longer and erect in humeral region; the yellow portion densely clothed with pale yellowish pubescence, a few nearly erect, long, black hairs intermixed; surface finely and sparsely punctate at extreme base, becoming closer at about basal fourth, and a little coarser toward the apex, punctuation irregular throughout, showing no tendency to become seriate. Abdomen impunctate, very sparsely clothed with long, black hairs. Mesosternum smooth, moderately clothed with semirecumbent, grayish-white pubescence. Legs rather short and stout, moderately clothed with rather long, white hairs. Length, 4.2 mm.

HOLOTYPE.—A male, No. 26991, Camuy, Porto Rico, August 8, 1922 (G. N. Wolcott, collector and donor), in the collection of The American Museum of Natural History.

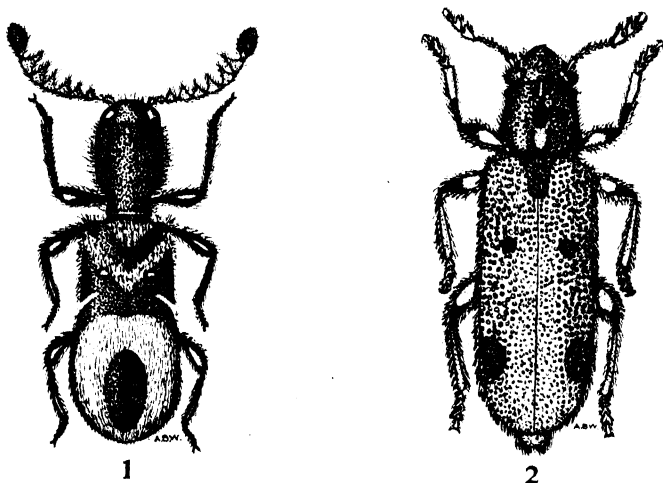


Fig. 1. *Callotillus crusoe*, new species.

Fig. 2. *Corinthiscus axinoides*, new species.

C. crusoe is allied to *C. elegans* Erichson (*occidentalis* Gorham), but differs from that species, as well as from *C. vaser* Wolcott, by the entire absence of seriate elytral punctures, its somewhat larger size, its rather broader form, and the impunctate metasternum and abdomen. The differently formed and arranged raised fasciæ or maculations are also distinguishing characters. The head and pronotum in *C. crusoe* are densely pubescent, sparsely so in the other species; the antennæ are differently formed, having a greater number of triangular segments; the color pattern is unique, the arrangement of the pubescence in basal half of elytra is distinctive, and the densely pilose elytral tubercles are elsewhere known only in *C. eburneocinctus* Wolcott.

This species is the first member of the family to be recorded from Porto Rico, and the first *Callotillus* known from any of the West Indian islands.

C. crusoe, as well as *elegans* and *vafer*, is placed in *Callotillus* provisionally only, as it differs from the other members of the genus in several important characters. No doubt, eventually the creation of a new genus will be necessary for the reception of this new species and *C. elegans* and *C. vafer*. In *C. eburneocinctus*, the genoholotype, the terminal segment of the maxillary palpi is subcylindrical, the eyes are emarginate internally and the abdomen has but five visible segments. In *elegans*, *vafer*, and *crusoe* the maxillary palpi have the terminal segment conical, the eyes are deeply emarginate anteriorly, and the abdomen has six distinct well-developed segments.

***Corinthiscus axinoides*, new species**

Figure 2

Elongate; black, feebly shining, clothed throughout with grayish pubescence; palpi, antennæ, legs (the knees black), elytra (a common scutellar maculation, the flanks in anterior half, a small fleck before the middle, and a large irregular lateral maculation at apical fourth, black) and abdomen (three basal segments broadly infusate at middle) ferruginous.

Head, including the eyes, subequal in width to pronotum at apex; black; surface coarsely, densely rugosely punctate; pubescence rather sparse, recumbent and erect, grayish white. Antennæ extending but slightly beyond base of elytra, eleven-segmented; segments one to five and nine, ten and eleven (the mass) longer than wide; segments six, seven and eight shorter, their width subequal to their length; basal segment rather stout, moderately long; second and fourth subequal in width and length; third one-third longer than second; fifth segment equal in length but slightly broader than the fourth; ninth and tenth segments much larger, width subequal to length, depressed, subtriangular and rather deeply emarginate at apex, thus producing a short, stout ramus at apical angle on anterior margin; eleventh one-third longer than tenth, depressed, gradually broader from base to the obliquely subtruncate apex, broadly infusate in about middle third; pubescence similar to that of head.

Pronotum black, slightly wider than long; surface sculpture same as that of head but much coarser; disk at middle with a large, slightly longitudinal, moderately deep depression; anterior to the depression a very fine, longitudinal carina extends nearly to apical margin; posterior to the depression a rather broad, nearly smooth, slightly elevated area extends nearly to base; pubescence same as that of head; apical margin arcuate; sides rather strongly constricted near apex, thence nearly straight and strongly divergent to basal third, in basal third strongly obliquely narrowed to base; base very slightly narrower than apex, subtruncate, scarcely perceptibly bisinuate, finely margined. Scutellum subtriangular, at middle longitudinally sulcate, black. Elytra at base slightly wider than prothorax at its widest part; length two and two-thirds times width at base; humeri obtuse; sides straight, parallel from humeri to about apical third, thence rather rapidly, arcuately narrowed to the con-

jointly rounded apices; flanks declivo-subinflexed, with lateral stripe not visible from above; surface very coarsely punctate; punctures cribrate, very irregularly arranged in series, those bordering the suture reaching to about the middle, those on the flanks and those upon the disk extending nearly to apex, and only slightly reduced in size but not more feebly impressed; punctuation of extreme apical portion coarse, irregular, not deeply impressed; intervals throughout rather finely, irregularly punctate; pubescence uniformly distributed, moderately dense, especially at apex, semierect, grayish white; color ferruginous; lateral margin from base nearly to middle rather broadly, and five maculations, piceous; first maculation common, of moderate size, surrounding the scutellum; second antemedian, small, irregularly rounded, nearer to suture than to flanks; third, at apical fourth, formed of a broad, longitudinal, marginal marking broadly coalescent with an irregularly rounded, discal maculation, the maculation as a whole reaching from the lateral margin two-thirds distance to suture. Metasternum rather coarsely and densely rugoso-punctate, its side pieces more finely punctate and obliquely strigose; pubescence sparse. Abdomen moderately coarsely, closely, rugoso-punctate, the posterior margin of three basal segments nearly smooth; sixth ventral semicircular; pubescence rather short, dense, recumbent, grayish white. Legs pale ferruginous, the knees black; pubescence moderately sparse; tibiae of anterior legs with outer margin in basal half irregular, in apical half closely, irregularly denticulate, the outer apical angle with a moderately large, strong tooth; tarsi with three basal segments nearly nude beneath. Length, 20.5 mm.

HOLOTYPE.—A male (?), No. 26992, San Carlos Estate, Rio Seco, Guantanamo, Cuba, July 4, 1915 (C. T. Ramsden, collector and donor), in the collection of The American Museum of Natural History.

This species, the largest *Pelonia* known to the writer and believed to exceed in size any other described species, remarkably resembles the Peruvian *C. riveti* Lesne in most details of structure and, to a considerable extent, in the coloration. It is, however, of much greater size (*riveti*, 6–8 mm.); the pronotum is proportionally broader, with its sides more strongly divergent, not from the apical margin but from the subapical constriction; the pronotal discal depression does not exceed in extent one-third the total length of the pronotum (entire in *riveti*); the rows of elytral punctures are longer and much more irregular and confused; the intervals punctate (smooth and shining in *riveti*); the tibiae of the anterior legs have their outer margin distinctly denticulate in apical half (simple in *riveti*); and the tarsi have the three basal segments nearly nude beneath (densely and very finely villose in *riveti*).

In the new species the system of coloration is much the same as in *C. riveti*, the principal difference being that in *riveti* the stripe bordering the lateral margin in basal half of the elytra is wanting, but the shoulders are marked with a piceous maculation, of which there is only the slightest trace in *axinoides*; and the post-median maculation is common, fascia-like, but irregular in outline and fails to reach the lateral margin of the elytra.

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NOTES ON WEST INDIAN LYCIDÆ AND LAMPYRIDÆ (COLEOPTERA), WITH DESCRIPTIONS OF NEW FORMS

BY ANDREW J. MUTCHLER

INTRODUCTION

In a recent paper (1922, Bull. Amer. Mus. Nat. Hist., XLVI, pp. 413-490) Mr. Leng and I gave a treatise on the then known species of Lycidæ, Lampyridæ, and Cantharidæ of the West Indies. We described thirty-five new species and three new varieties, making a total of one hundred and ten species and seven varieties treated. Since that time I have had the privilege of examining a number of West Indian species belonging to these families, among them some species which I believe to be new, and several which offer locality records not heretofore recorded.

The specimens were received from several different sources: British Museum, sent by Mr. G. J. Arrow; Mr. Geo. N. Wolcott of the Insular Experiment Station at Rio Piedras, Porto Rico; University of Iowa, sent by Dr. Dayton Stoner; Estacion Experimental Agronomica, Santiago de las Vegas, Cuba, sent by Mr. Stephen C. Bruner, Chief of the Department of Entomology and Vegetable Pathology; and a number from Haiti, collected by Mr. F. E. Watson of this Museum, whose expedition to that part of Hispaniola was made possible through the generosity of Mr. B. Preston Clark.

The locality records for the specimens collected in Haiti by Mr. Watson are in many cases accompanied by field notes. There are also some records which refer to small, somewhat obscure, places not indicated on most maps of the Haitian Republic. The following is a list of these localities with the field notes.

PORT AU PRINCE. Material taken near Hotel Montagne, about two miles southeast of center of town. Altitude about 250 to 350 feet.

CARREFOUR. On the south coast of Port au Prince Bay, about seven miles west of the city of Port au Prince.

PETIONVILLE. About seven miles southeast of Port au Prince and located in the hills at about 1400 feet altitude.

MANVILLE. At the western end of Lake Assuëi (called Assuëi or Etang Saumatre). The present termination of the railroad running east from Port au Prince. Altitude about 60 feet.

FOND PARISIEN. On the south shore of Lake Assuéi, about ten miles on a straight line (across the lake) southeast of Manville. Collecting done in the plantations back from the beach. This region would be arid except for irrigation. Altitude about 60 feet.

LA MORINIÈRE. Along the railroad about thirteen miles east of Port au Prince. Altitude about 125 feet.

PONT BEUDET. One station west of La Morinière, or about eleven miles east of Port au Prince. Altitude about 100 feet.

AUX CAYES. (On some maps as Cayes). Fort Ilet district along the coast to about one and one-half miles east of the town and in plantations a short distance back from the coast. This region is studded with lagoons and marshes. Collecting also done about one and one-half miles west of the town to the River La Ravine.

CHARPENTIER. About three to five miles north of Aux Cayes, approximately at sea-level.

SUPPLICE. On St. Marc Bay, about two miles south of St. Marc.

PIVERT. About two and one-half miles inland east of St. Marc. Altitude 100 to 400 feet.

In the following records and descriptions, which include the Lycidæ and Lampyridæ, exclusive of the genera *Photinus*¹ and *Photuris*, I have arranged the genera in the same order as in the recent paper by Mr. Leng and myself on these families, and have also, where known, given the collector's name (in parenthesis) after the locality records and indicated the collections in which the various specimens are located.

LYCIDÆ

***Thonalmus dominicensis* (Chevrolat)**

HAITI: Aux Cayes, March 15-18 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

***Thonalmus chevrolati* (Bourgeois)**

HAITI: La Morinière, March 1-5; Aux Cayes, March 15-18; Charpentier, March 19; Pivert, April 1 (F. E. Watson); Coll. Amer. Mus. Nat. Hist. I have also seen specimens from Haina, DOMINICAN REPUBLIC, in the collection of Geo. N. Wolcott.

***Thonalmus suavis* (Jacquelin Duval)**

CUBA: Santiago de las Vegas, December 23 (J. Acuna); Coll. Amer. Mus. Nat. Hist.

***Thonalmus amabilis* (Jacquelin Duval)**

CUBA: Taco Taco, April 1-6 (S. C. Bruner, J. Acuna, and C. H. Ballou); Nagua Oriente, July 7, 1922 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

***Thonalmus aulicus* (Jacquelin Duval)**

CUBA: Nagua Oriente, July 7 (S. C. Bruner, and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

¹There are, among the material received from the various sources spoken of in the introduction of this paper, several records of Lampyridæ belonging to the genera *Photinus* and *Photuris* and some species of Cantharidæ. I hope to publish these in the near future.

Thonalmus aulicus variety **distinguendus** (Jacquelin Duval)

CUBA: Taco Taco, April 1-6 (S. C. Bruner, J. Acuna, and C. H. Ballou); Santiago de las Vegas, April 28 (S. C. Bruner); Coll. Amer. Mus. Nat. Hist.

LAMPYRIDÆ**Alecton discoidalis** Castelnau

CUBA: Santiago de las Vegas (B. T. Barreto); Coll. Amer. Mus. Nat. Hist. Santiago de las Vegas (M. Plasencia and J. Acuna); Coll. Estacion Exp. Agronomica, Cuba.

Alecton flavum Leng and Mutchler

CUBA: Taco Taco, April 1-6 (S. C. Bruner, J. Acuna, and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

LUCIDOTA Castelnau

Among the material sent to this Museum by Mr. Stephen C. Bruner are several specimens which represent three new species. I have placed them in this genus as they have the strongly compressed serrate (especially in the male) antennæ. One of the species has the antennæ of the male a little longer than the body; in another the male antennæ are just about the length of the body; while in the third species the male antennæ are somewhat shorter. I am also describing as new one other species and a variety represented by specimens in the National Museum Collection, which Mr. Leng and I failed to describe in our paper on the species. In general outline the species which have been placed in this genus come close to *Photinus*, but can be separated from that genus by their serrate antennæ. In this connection it may be well to quote a translation of one of Ernest Olivier's remarks on the subject: "Some *Photinus* with compressed antennæ come close to this genus but one must note that in these the joints of the antennæ are merely depressed without being dentate or triangularly broadened."

The West Indian representatives of *Lucidota* could be separated into groups, based on the relative length and more or less strong serration of the male antennæ. These characters do not hold good for the females as, in all of the specimens of this sex which I have examined, the female antennæ are approximately of the same length and the serration does not show any marked difference between the species. I have, therefore, in the following key, avoided using the male antennal character, except for species which could not otherwise be very clearly separated.

Of the species here discussed from the West Indies two are found in Porto Rico, one in Dominica, while all of the others are confined to Cuba. The species found in Porto Rico and Dominica are so noted in the key.

- 1.—Disk of pronotum yellow, without rosy color 2.
 Disk of pronotum more or less red (rosy), with or without black or dark markings 3.
- 2.—Pronotum darker at the apex; small species, less than 5 mm. in length. *fulvotinctus*.
 Pronotum wholly yellow, larger, 6.5 mm. in length. *fulvotinctus* var. *flavicollis*.
- 3.—Pronotum with a well-defined black mark on middle of the disk 4.
 Pronotum not generally marked with darker color, but if marked with darker color, then with a black or brownish spot at apex or an ill-defined dark cloud on the central portion of disk 7.
- 4.—Elytra black or brownish black, not margined with paler color (Dominica). *incognita*.
 Elytra margined with paler color 5.
- 5.—Discal black markings on the pronotum broad and of approximately the same width throughout; antennæ of male somewhat strongly serrate and about two-thirds the length of the body (Porto Rico) *marginipennis*.
 Discal black marking on the pronotum much narrower at base than at apex. . 6.
- 6.—Sutural and lateral pale margins of the elytra more or less disconnected at the apex, leaving the apical margins dark; antennæ of male strongly serrate and about as long as the body; pygidium of male narrowly rounded at apex. *bruneri*.
 Pale margins of the elytra continuous around the apex; antennæ of male more moderately serrate and about one-half the length of body; pygidium of male squarely truncate at apex. *subdubitata*.
- 7.—Pronotum with a dark spot at the apex; scutellum pale yellow; antennæ of male very strongly serrate and somewhat (at least the length of the apical joint) longer than the body. *chevrolati*.
 Pronotum generally without dark marking at apex; antennæ of male not longer than the body 8.
- 8.—Scutellum pale to dark brown; sutural and lateral pale markings of the elytra more or less disconnected at the apex, leaving the apical margin dark or very narrowly pale, and sometimes with the sutural margin dark; antennæ of male moderately strongly serrate and not quite as long as the body. *miniatocollis*.
 Sutural and lateral margins of the elytra continued more or less broadly around the apex; antennæ of male somewhat strongly serrate and about as long as the body (Porto Rico) *decorus*.

***Lucidota fulvotinctus*, new species**

MALE.—Pale brown. Head pale to dark brown, palpi brown, mandibles paler. Antennæ about two-thirds the length of the body, serrate from the third joint, all of the joints dark brown. Pronotum yellow on the disk, brownish at apex, submargins and apex somewhat coarsely with disk less coarsely punctate; disk with a median channel extending from the base to the middle. Scutellum brownish yellow. Elytra pale brown, margined at the sides and suture with paler color, apex not completely margined, pubescence short, yellow. Underside pale brown with a darker brown mark on the sides which extends from the prosternum and covers the metasternum, then

extends along the ventral segments, leaving the lateral margin and central portion pale brown to the seventh segment, this and the eighth segment wholly pale yellowish brown. Legs brown, femora slightly darker. Length, 4–4.5 mm.

FEMALE.—Unknown.

Described from two male specimens collected by E. A. Schwarz at Cayamas, CUBA, May 18 and 31.

Holotype: Coll. U. S. Nat. Mus. Paratype: No. 26962; Coll. Amer. Mus. Nat. Hist.

***Lucidota fulvotinctus* variety *flavicollis*, new variety**

MALE.—Pale brown. Head yellow, slightly infusate at the front, palpi and mandibles yellow, the latter brown at apex. Antennæ about two-thirds the length of body, serrate from third joint, first to third joints more or less pale beneath. Pronotum yellow, apex and sides somewhat coarsely with disk less coarsely punctured; disk with a median channel extending from the base to about the middle. Scutellum yellow. Elytra pale brown, margined, except at base, with yellow, covered with a short yellow pubescence. Underside and legs, pale yellow. Length, 6.5 mm.

FEMALE.—Unknown.

Holotype: Baracoa, CUBA; September; Aug. Busek, Collector; Coll. U. S. Nat. Mus.

The above species and variety are represented by specimens which Mr. Leng and I set aside when studying the West Indian Lampyridæ, but my further study has convinced me that they represent a species unlike anything previously described. They have the elytra light brown in color, with the thorax yellow, differing in this respect from other West Indian species of the genus which have the elytra dark brown or black and the thorax more or less tinged with rosy red.

The specimens from which the species were described were examined by the late Ernest Olivier and returned to the U. S. National Museum without a name.

***Lucidota miniatocollis* Chevrolat**

There are thirteen specimens in the material we received from Mr. S. C. Bruner which are smaller (5–6 mm. in length) than the specimens Mr. Leng and I considered as belonging to *miniatocollis*, but otherwise they agree with the description which we gave of the species. They are from CUBA: Nagua Oriente, July 7; Sierra Maestra, July 10–20; and Taco Taco, April 1–6; (S. C. Bruner, J. Acuna, and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.; Nagua Oriente, July 7 (S. C. Bruner and C. H. Ballou); Taco Taco, April 1–6 (S. C. Bruner, J. Acuna, and C. H. Ballou); Los Sibalos, Ciénga de Zapata, July 19, on *Chrysobalanus icaco*; Coll. Estacion Exp. Agronomica, Cuba.

***Lucidota subdubitata*, new species**

MALE.—Elongate, brownish black. Head black on the occiput, labrum and space between the antennæ paler. Mandibles pale brown, darker at the tips. Palpi brown, apical joint black. Antennæ black, pubescent, slightly more than one-half the length of the body, serrate from the third joint. Pronotum somewhat narrowly rounded at apex, hind angles slightly acute, margins pale yellow, somewhat translucent, subapical margin black; disk rosy with a more or less noticeable median channel and with a median black marking which extends narrowly, for a short distance, along the basal margin and is more or less narrowed basally, becoming broader apically and fusing with the broad apical spot. Elytra black, margined except at base with yellow, pubescence yellowish. Pygidium dark at base paler apically, somewhat broadly and squarely truncate at apex. Prosternum rosy, this color extending more or less into the apex of the mesosternum which is otherwise black. Ventral segments of the abdomen dark, last two segments somewhat paler in one specimen. Legs piceous, femora somewhat paler. Length, 8.5 to 11.5 mm.

FEMALE.—Similar in color and markings to the male. Head between the eyes not as pale. Antennæ shorter, less serrate. Pygidium black triangular, narrowed at apex. Femora in one specimen paler on the inner side and basally. Last ventral segment of the abdomen slightly paler and with light organs at each side of the base. Length, 10.5 to 13 mm.

CUBA.—Holotype male, No. 26964, and allotype female, No. 26965, summit¹ of Pico Turquino, July 22, 1922. Paratype female, No. 26966, Sierra Maestra, July 10–20, 1922. Paratype male, No. 26967, summit of Pico Turquino, July 22, 1922 (C. H. Ballou and S. C. Bruner); Coll. Amer. Mus. Nat. Hist. Paratypes, female, Pico Turquino, July 20 and 22; alt. 5500 to 6000 feet and summit (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

***Lucidota bruneri*, new species**

MALE.—Elongate, blackish brown. Head black, pink around the antennal sclerite, (possibly deciduous). Mandibles dark at tip. Palpi dark brown, somewhat thickly covered with yellowish pubescence. Antennæ dark brown, approximately as long as the body, strongly serrate from the third joint, covered with short, stiff, brown hairs. Pronotum somewhat broadly rounded at apex, hind angles straight; side margins pale, somewhat translucent, apical margin with a dark spot, basal margin rosy at the central portion, side, apical and basal margins with somewhat coarse punctures, disk rosy, somewhat obsoletely channeled, finely punctate and with a black central marking which extends narrowly from the base and joins with the broad apical spot; in one specimen the basal part of the discal black mark is almost entirely obliterated leaving only a small dark spot at the base and becoming dark again at about the middle. Scutellum dark brown. Elytra brownish black, margined at the suture and sides with pale yellow, apical margins darker; closely punctate and covered with a very short brown pubescence. Pygidium rounded at apex, pale yellow, slightly darker basally. Underside dark brown. Prosternum and middle

¹There are several specimens among the material sent by Mr. S. C. Bruner which are marked "Cumbre" (Summit) when referring to altitude. All specimens so marked are from Pico Turquino, the summit of which, according to published records, is approximately 2400 meters (about 7800 feet) above sea-level.

of apex of mesosternum extending into the coxal cavities rosy, other parts of mesosternum and ventral abdominal segments, except the last two, dark brown, last two (including the eighth) segments pale yellow. Legs dark brown. Length, 12 mm.

FEMALE.—Unknown.

CUBA.—Holotype, No. 26963, summit of Pico Turquino, July 22, 1922 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Three paratypes near Pico Turquino, July 20, alt. 4500 to 5000 feet and Pico Turquino, July 22, alt. 4500 to 5500 feet and summit (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

This species and *subdubitata* are somewhat similar in size and color markings but the males can readily be separated on the following characters. In *subdubitata* the antennæ are much shorter than the body; the basal angles of the thorax are slightly acute and the discal dark marking in all the specimens I have seen extends narrowly for a short distance along the basal margin; the apical margins of the elytra are not clouded with darker color but are as pale as the sutural and lateral margins and the pygidium is dark and squarely truncate at the apex.

***Lucidota chevrolati*, new species**

MALE.—Elongate. Front of head, antennæ, and palpi black. Antennæ much flattened, strongly serrate from the third joint, longer than the body by more than the length of the last joint. Pronotum rosy on the disk, side margins yellow, apex with a fuscous spot, disk with a short, shallow impression. Scutellum yellow, rosy at the base. Elytra black, margined at the sides and suture with pale yellow, extreme apical margins dark; punctate and covered with a short, pale brown pubescence. Underside of thorax pale yellow with rosy tint. Meso- and metasternum pale yellow with side pieces of both and central portion of metasternum dark. First to sixth ventral segments whitish yellow at the sides and middle, broadly brown at the sublateral margins, seventh segment pale whitish yellow, eighth pale brown. Legs pale brown, with inner side of femora paler. Length, 6.5 to 7.5 mm.

FEMALE.—Unknown.

CUBA.—Holotype, No. 26968, and paratype, No. 26969, Sierra Maestra, July 10–20, 1922, alt. 2000 to 3000 feet (C. H. Ballou and S. C. Bruner); Coll. Amer. Mus. Nat. Hist. Two paratypes, Sierra Maestra July 10–20, 1922, alt. 2000 to 3000 feet (C. H. Ballou and S. C. Bruner); Coll. Estacion Exp. Agronomica, Cuba.

The males of this species and *bruneri* have the antennæ longer and more strongly serrate than any of the other West Indian species of the genus. The two species may be readily separated on their relative size, also *bruneri* has the central portion of the disk of the pronotum more or less marked with darker color; the scutellum dark brown and the ventral surface of the body darker colored.

I have been informed by letter from Mr. Stephen C. Bruner, from whom the specimens which I have described as *chevrolati* were received, that there are in the Gundlach collection at Havana specimens which

may be representatives of this species. These specimens bear the specific name *virilis*. I can find no description of any such species and, therefore, believe *virilis* to be a manuscript name.

***Callophisma monticola*, new species**

MALE.—Elongate oval, reddish yellow, front of head, antennæ, palpi, apical two-thirds of the elytra, tibiæ, tarsi and protruding parts of dorsal segments, except pygidium, black or dark brown. Head prolonged and narrowed in front. Mandibles reddish yellow, slightly darker at tips. Palpi large, four jointed. Antennæ compressed and moderately serrate from the third joint, about one-half the length of the body. Pronotum wider than long, apical and lateral margins broadly turned up, somewhat translucent and coarsely punctured, disk yellow with (in one specimen) a small black spot on the middle of the basal half, central portion with a short, narrow impressed line. Elytra with about basal third reddish yellow; somewhat finely and closely punctate, pubescent. Pygidium bisinuately truncate, the middle lobe being much shorter than the lateral ones. Legs compressed. Length, 11 to 11.5 mm.

FEMALE.—Unknown.

CUBA.—Holotype, No. 26970, and paratype, No. 26971, Pico Turquino, July 20, 1922, alt. 5000 to 5500 feet (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Four paratypes, Pico Turquino, July 20, 1922, alt. 4500 to 5500 feet (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

This species is similar in color and length to *borencona*, but *monticola* is much broader, the thorax is more broadly rounded at the apex, the apical black color of the elytra does not end in as straight a line but is irregularly indented where it meets the yellow color, and the dorsal abdominal segments which protrude beyond the ventral ones are black. These segments do not protrude as far and are of the same color as the ventral ones in *borencona*.

***Callophisma maestra*, new species**

MALE.—Elongate oval. Antennæ black, approximately two-thirds as long as the body in the holotype, but in the seventeen specimens examined the antennæ vary in length from only slightly more than one-half the length of the body to at least as long as the whole insect; third and following joints compressed, feebly serrate, densely pubescent. Head prolonged and narrowed in front, ranging in color from dark brown to yellow. Palpi dark, four jointed. Pronotum orange-yellow, about twice as broad at base as long, margins turned up, disk with a somewhat narrow median channel extending from the sub-basal margin to the middle. Elytra yellow at basal part, apical part extending beyond the half, and in one specimen to the basal third black; pubescence short; disk with three costæ, two on the upper portion and one on the sublateral margin, one or more of these costæ very vaguely outlined in some specimens. Pygidium bisinuately emarginate. Underside yellow. Femora yellow, darker at extreme base. Tibiæ and tarsi dark brown. Length, 7 to 8.5 mm.

FEMALE.—Unknown.

CUBA.—Holotype, No. 26972, and six paratypes, No. 26973, Sierra Maestra, alt. 4000 to 5000 feet, July 10–20, 1922; one paratype, No. 26974, Pico Turquino, alt. 4500 to 5000 feet (C. H. Ballou and S. C. Bruner); Coll. Amer. Mus. Nat. Hist. Five paratypes, Sierra Maestra, July 10–20, 1922, alt. 3000 to 4000 feet; Pico Turquino, July 20, 1922, alt. 3000 to 5000 feet (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

This species somewhat resembles *emarginata* in color-markings, but *maestra* is less broadly oval. The antennæ are generally longer; the disk of the thorax is yellow without rosy hue, and the apical black portion of the elytra extends farther toward the base. The differences in the antennal length, which result from a proportionate lengthening or shortening of each joint, are the most remarkable variations observed in my study of the West Indian Lampyridæ.

There is also, among the seventeen examined, one specimen which has the left antenna distorted in such a manner that the apex of the eighth and base of the ninth joint are unusually broadened and from the apex of the eighth and attached to the inner basal part of the ninth joint is a one-jointed projection which resembles an apical antennal joint. This projection is about twice the length of the ninth joint. The left antenna is also somewhat shorter than the right one.

Callophisma postica (E. Olivier)

HAITI.—Pont Beudet, March 3–4 (F. E. Watson); Coll. Amer. Mus. Nat. Hist. ST. DOMINGO.—No definite locality; Coll. British Museum.

Callophisma borencona Leng and Mutchler

PORTO RICO.—No definite locality, Coll. British Museum; Vega Alta, January 7 (R. T. Cotton); Larres, June 14 (Geo. N. Wolcott); Coll. Insular Exp. Sta. Porto Rico.

Callophisma adjuncta (E. Olivier)

CUBA.—Palma Mocha, Sierra Maestra, July 10–20, alt. 3500 to 4370 feet (C. H. Ballou and S. C. Bruner); Coll. Estacion Exp. Agronomica, Cuba.

Callophisma fuscotermia, new species

MALE.—Elongate oval, reddish yellow. Front of head flat, pubescent. Mandibles darker at apex. Antennæ black, first joint slightly paler basally; moderately serrate from third joint on. Pronotum moderately narrowly rounded at apex, basal angles acute, disk with a short, shallow, longitudinal impression at basal center; submargins somewhat coarsely punctate, disk more finely punctate; pubescence sparse. Elytra reddish yellow for about the basal two-thirds, apical third black, the two colors joining in a somewhat straight line; discal costæ more or less obscure; moderately finely punctate and covered with a short pubescence. Underside reddish yellow. Femora and tibiæ reddish yellow. Tarsal joints black at apex, claw joint reddish yellow. Length, 7.5 mm.

FEMALE.—Unknown.

CUBA.—Holotype, No. 26975, Taco Taco, April 1-6, 1922 (S. C. Bruner, J. Acuna and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

This species comes close to *postica* in color, but the insect is broader throughout. The thorax is more broadly rounded at the apex and the basal angles are more acute.

It should be placed in the key to species of *Callopisma* (Leng and Mutchler, 1922, Bull. Amer. Mus. Nat. Hist., XLVI, p. 439) in the section with *ramsdeni*, but can be separated from that species by the color of the legs, etc. The tibiæ are pale in this species and black in *ramsdeni*. It is also not as broad as *ramsdeni* but rather intermediate in that respect between *ramsdeni* and *postica*.

***Callopisma ramsdeni* Leng and Mutchler**

CUBA.—Near Nagua Oriente, July 7, alt. 700 to 900 feet (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. and Coll. Estacion Exp. Agronomica, Cuba.

***Callopisma bellicosa* (E. Olivier)**

CUBA.—St. Vincente, April 6-9 (S. C. Bruner and J. Acuna); Coll. Amer. Mus. Nat. Hist.

***Callopisma janthinipennis* (Jacquelin Duval)**

CUBA.—Est. Cent. Agric. de Cuba, June 11 and October 7 and 12, on leaves of sugar cane (B. T. Barreto); Coll. Amer. Mus. Nat. Hist. and Coll. Estacion Exp. Agronomica, Cuba.

ERYTHROLYCHNIA Motschulsky

This genus, peculiar among the Lampyridæ on account of the males having only seven segments on the ventral part of the abdomen, seems to be confined to the island of Hispaniola. The six species (one of which I am describing as new) thus far included in the genus are from that island. The species may be separated by the following key.

- 1.—Elytra black at apex only.....2.
- Elytra with both base and apex black or brown.....4.
- 2.—Color dull yellow; antennæ pale in color, basal part of all the joints pale, apical ends waxy white; palpi pale brown.....*albopalpis*.
- Color reddish or reddish yellow, antennæ dark in color and apical parts of joints similar in color to their central portion; palpi dark.....3.
- 3.—Pronotum generally with two small, almost approximate dark spots on the central portion of disk; apical black mark on the elytra at its greatest length, approximately one-half the length of the elytra.....*fulgidus*.
- Pronotum without black spots; apical black spot on the elytra at its greatest length, one-fourth to one-third the length of the elytra.....*bipartitus*.

- 4.—Disk of pronotum without black or dark spot; apical and basal black spots on the elytra small but well defined. Length, 9 mm. *olivieri*.
 Disk of pronotum with dark spot. 5.
 5.—Color somewhat pale yellow; apical and basal black spots on the elytra small, apical ones sometimes ill defined. *quinenotatus*.
 Color reddish brown; apical and basal spots on the elytra very black, well defined, apical spots larger than the basal ones. *clarki*.

***Erythrolychnia bipartitus* (E. Olivier)**

ST. DOMINGO.—No definite locality; Coll. British Museum.

***Erythrolychnia quinenotatus* (Castelnau)**

ST. DOMINGO.—No definite locality; Coll. British Museum. HAITI.—Port au Prince (at light), January 1 to April 7 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

***Erythrolychnia clarki*, new species**

Figure 1

Reddish brown. Front of head blackish brown, somewhat deeply excavated between the eyes in the male, nearly flat in the female. Antennæ blackish with basal joint and basal part of each joint reddish brown; pubescent and with longer stiff hairs, especially noticeable on the apical ends of the joints. Pronotum broadly rounded in front, basal angles slightly acute; anterior and lateral margins turned upward; lateral submargin somewhat more deeply impressed apically; somewhat coarsely punctate, more finely on the disk than on the margins; pubescence short, yellowish; disk with an elevated ridge which extends from the basal margin to about the apical third, and with a large, more or less squarely outlined, discal black spot which does not extend to the basal margin. Scutellum moderately punctate and somewhat thickly clothed with a short yellow pubescence. Elytra elongate oval, base and apex black, basal black color covering the basal and humeral margins and the sutural margin from the base to the apex of the scutellum where it branches outward from the suture; it also somewhat irregularly curves from the lateral margins a short distance behind the humeri, extending on the disk to about one-third the length of the elytra. The apical black marking extends to about the middle on the disk of the elytra and is slightly more advanced on the middle of the disk than on the lateral margin and about twice as far as on the suture, making a V-shaped sutural indentation of the red color. Underside yellowish brown, pubescent; ventral segments of the abdomen more or less mottled with darker color, fifth segment with a luminous spot on its central portion which extends to the apical and basal margins and about one-half the width to the side margins. Legs reddish brown, last joint of tarsi slightly darker. Length, 11.5 to 14 mm.

HAITI.—Holotype male, No. 26976, and allotype female, No. 26977, Charpentier, March 19, 1922. Two male and two female paratypes, No. 26978, La Moriniere, March 1-5; Aux Cayes, March 15 to 18; Charpentier, March 19 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

This species is generally larger than any of the other five species of the genus. The black color on the apex of the elytra is similar in outline

to that on *fulgidus*. The basal black marking is much larger and the spot on the pronotum is also much larger than in any of the other species which are similarly marked; this spot, in some of the specimens, is slightly indented at the middle of the base with paler color.

Dedicated to Mr. B. Preston Clark in recognition of his many generous gifts to the American Museum and especially those which enabled Mr. Watson to make an expedition for this Museum to Haiti during the winter of 1921 to 1922.

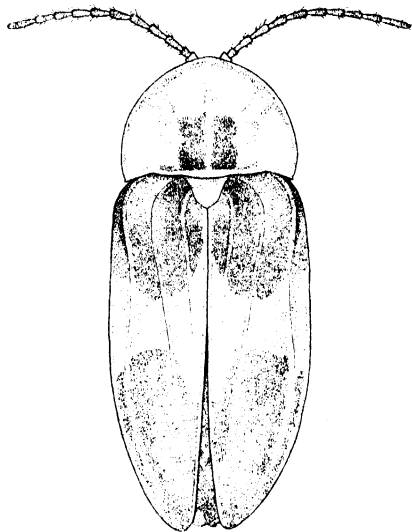


Fig. 1. *Erythrolychnia clarki*, new species. Type.

***Aspisoma ignitum* (Linnaeus)**

ANTIGUA.—June 1 and July 12 (L. Stoner); Coll. Univ. of Iowa.

***Pyrractomena vitticollis* Motschulsky**

This species was not represented in the collections which Mr. Leng and I had before us during our studies of the West Indian material but it has since been collected by Mr. F. E. Watson.

In Bull. Amer. Mus. Nat. Hist., XLVI, p. 454, Mr. Leng and I gave a translation of Motschulsky's description of the species which reads: "Pronotum testaceous with two very approximate brown vittæ each having at base an orange spot which reaches the margin in some examples. Elytra black, bordered with testaceous. Scutellum black,

bordered with yellow. Length, 8.6 mm." The three specimens which were collected by Mr. Watson vary slightly from the above, as the following description will point out.

Pronotum testaceous, with two dark brown vittæ on the disk which are approximate to, but do not reach, the apical and basal margins; basal parts of the vittæ somewhat squarely turned outward and extending along the sub-basal margin at right angles with the discal portion of the vittæ, the rosy spot on the disk extends from the dark sub-basal line toward the apex, covering nearly the basal half of the pronotum, but the rosy color does not extend to the margins. Scutellum dark, without perceptible paler margins. Elytra dark, margined, except at base, with yellow, lateral pale color slightly broader than the sutural. Underside dark brown. Female with the central portion of the five basal ventral segments of the abdomen yellow, sixth and seventh margined at apex with yellow; seventh with a somewhat narrow Λ -shaped incision at the apex. Male with the four basal segments yellow at their central portion, fifth and sixth yellow, seventh and eighth brown; seventh squarely truncate. Legs dark brown, apex of femora and tibiæ darker. Length, 10 mm.

HAITI.—Carrefour, January 7; Manville, February 6-10; Aux Cayes, March 15-18 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

***Pyractomena galeata* E. Olivier**

PORTO RICO.—La Pata, June 11 (G. B. Merrill); Coll. Insular Exp. Sta. Porto Rico.

***Pyractomena gamma* (Jacquelin Duval)**

CUBA.—Manzanillo, July 31 (C. H. Ballou and S. C. Bruner); Playa de Batabano; Coll. Amer. Mus. Nat. Hist.

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SIX NEW BATRACHIANS FROM THE DOMINICAN REPUBLIC

BY G. K. NOBLE

Through the generosity of Museum friends, the donors of the "Angelo Heilprin Exploring Fund," an expedition was sent during the past summer to study the reptiles and amphibians of the Dominican Republic.

Although the primary purpose of the expedition was to secure exhibition material, a large amount of scientific data was brought together at the same time. The present paper deals briefly with the new species of Salientia secured by the expedition. In a subsequent paper, now in preparation, these species will be more fully discussed. This second paper will deal with the habits and life histories of most of the Dominican Amphibia. The species described below will be figured in that paper and a comparison of their voices and habits made. It may be stated here that all the species described below have a distinctive voice and coloration in life. Never in the field did the slightest confusion arise in recognizing the species. In the following descriptions the distinctive features of only preserved material have been indicated. Each species is represented in our collections by a large series of specimens.

Hyla heilprini,¹ new species

DIAGNOSIS.—A medium-sized *Hyla* differing remarkably from any other Greater Antillean species in possessing a dagger-shaped prepollex visible in both sexes but enormously developed and with exposed point in the male; fingers two-thirds, toes completely webbed; vomerine teeth in two straight series on a level with the posterior border of the choanae. Coloration in preserved material largely dependent on fixation; a series of transverse bars of a dark color and a scattering of white specks usually present on the dorsal surface and readily distinguishing the species from other Dominican forms.

TYPE.—A. M. N. H. No. 11401; adult, ♂; among stones in ravine of mountain torrent, Lo Bracita, Prov. Pacificador; August 20, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Tongue broader than long, emarginate behind; vomerine teeth in two groups in contact and forming almost a continuous series between the choanae on a level with their posterior margin; head much broader than long; nostrils near the end of the snout, the distance from the extreme tip (midpoint) of

¹Named in honor of the late Professor Angelo Heilprin, geologist, artist, philosopher; student of natural phenomena in the West Indian region.

snout to nostril contained more than two times in the distance between nostril and eye; snout rounded; interorbital width greater than the greatest diameter of the eye; no indication of ossification in the derm of head; canthus rostralis rounded, the loreal region sloping gradually; tympanum distinct, slightly more than half the greatest diameter of the eye. Hind limb being adpressed, the tibio-tarsal articulation reaches nearly to the nostril; digits with large discs, of the same diameter as the tympanum; fingers two-thirds webbed, toes completely webbed (but the web does not reach the disc of the fourth toe); a large, recurved prepollex with an exposed spine directed inward. Skin finely glandular above, almost smooth; skin of abdomen and ventral surfaces of the thighs coarsely granular; a supra-tympanic fold but no dorso-lateral one; a subgular vocal sac present.

Ground tone (of preserved specimen) pale grayish blue above, suffused with a darker tone; some indication of nine transverse bars of a dark brown on the back; a more distinct series of five or six bars on the thighs; upper surface sprinkled with about thirty small white spots; ventral surfaces straw-color to yellowish; axilla a bright orange; groin and inner side of arms and part of the gular region a bluish tone; posterior surfaces of thighs of the same pale tone as the ventral surfaces.

MEASUREMENTS

Tip of Snout to Vent.....	48.0 mm.
Tip of Snout to Posterior Border of Tympanum.....	17.0
Greatest Breadth of Head.....	18.5
Distance from Axilla to Tip of Longest Finger.....	31.0
Distance from Vent to Tip of Longest Toe.....	81.0
Tibia.....	26.0

Eleutherodactylus flavescens,¹ new species

DIAGNOSIS.—A medium sized *Eleutherodactylus*, with broad head and depressed body. Readily distinguished from all other Dominican frogs by its notched digital expansions, warty skin, and distinctive coloration.

TYPE.—A. M. N. H. No. 11402; adult, ♀; bushes along stream bank, Lo Bracita, Prov. Pacificador, Dominican Republic; August 8, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Head slightly broader than long, broader than the body; distance between anterior corner of eye and nostril equals the interorbital width, two and a half times as great as the distance between nostril and tip of snout; canthus rostralis sharp, but the loreal region not concave; tympanum very distinct, one-half the greatest diameter of the eye, separated from the eye by a trifle less than half its own diameter. Tibio-tarsal joints of either side overlap when the legs are placed at right angles to the body; tibio-tarsal articulation reaches midway between eye and nostril. Discs of fingers and toes very pronounced, more or less distinctly notched anteriorly, the outer fingers appearing heart-shaped; digits slender; a rudiment of a web between the two outer toes, other digits free; a slight indication of a tarsal fold. Vomerine teeth in two arched series extending outward slightly beyond the inner edge of the choanæ, the two series separated from each other by a space equal to half the length of one series; vomerine teeth well behind the choanæ, separated from them

¹Named in reference to its yellowish coloration in life.

by a space equal to the distance between the two series of vomerine teeth; tongue large, slightly nicked behind. Skin warty above, the warts of various sizes and tending to form longitudinal series. The largest warts form a row on each side of the body, the next largest form a dorso-lateral row on each side and a medial row; between these five rows smaller warts tend to form one or more regular rows; ventral surfaces of abdomen and thighs granular.

Ground tone (in alcohol) pale grayish to straw-color; dorsum marked with an irregular pattern of dark brownish or black markings. Of these the most conspicuous is a wedge-shaped mark between the eyes, an irregular W on the shoulders and an irregular figure on the sacrum; the dark tone forming a canthal stripe, a tympanic ring, three or four cross stripes on the fore arm, and a few irregular bars on the tibia.

MEASUREMENTS

Tip of Snout to Vent.....	36.0 mm.
Tip of Snout to Posterior Border of Tympanum.....	12.5
Greatest Breadth of Head.....	13.8
Distance from Axilla to Tip of Longest Finger.....	23.0
Distance from Vent to Tip of Longest Toe.....	60.0
Tibia.....	20.0

***Eleutherodactylus auriculatoides*, new species**

DIAGNOSIS.—Closely allied to *E. flavescens* and *E. auriculatus*; distinguished from the latter by its smaller size, broader head, shorter leg and different coloration.

TYPE.—A. M. N. II. No. 11403; adult, ♀; bromeliads near Constanza-Jarabacoa Trail, Paso Bajito, Dominican Republic; September 4, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Head broader than long, broader than body; distance between anterior corner of eye and nostril equals the greatest diameter of the eye, a trifle less than the interorbital width; distance between nostril and tip of snout contained a trifle over two times in the distance between nostril and eye; canthus rostralis distinct, although the loreal region slopes gradually; tympanum distinct, its greatest diameter equal to a trifle less than half the greatest diameter of the eye; separated from the eye by a space equal to its diameter. Tibio-tarsal joints of either side overlap when the legs are placed at right angles to the body; tibio-tarsal articulation reaches the posterior corner of the eye. Disks of fingers and toes pronounced, rounded; digits free; second toe (measured with dividers from distal side of its base) longer than first; no tarsal fold. Vomerine teeth in two oblique series well behind choanæ, extending outward not beyond the inner edge of the choanæ; the two series separated from each other by less distance than that which separates them from the choanæ; tongue thick, slightly nicked behind. Skin finely granular above; the granules forming more or less regular rows on the sides; belly, and thighs (except flash surfaces) coarsely granular.

Ground tone (in alcohol) a pale gray or flesh-color; tip of snout and parietal region with adjacent parts of eyelids dark reddish brown, this giving the appearance of a light band across the head in front of the parietal region; a canthal and supra-tympanic streak of dark reddish brown; back and upper surfaces of limbs diffused with brown, leaving only an indistinct W on the occiput and a)(mark anterior to the pelvis of the pale ground tone; ventral surfaces straw-color, slightly diffused with brown on the sides.

MEASUREMENTS

Tip of Snout to Vent.....	33.0 mm.
Tip of Snout to Posterior Border of Tympanum.....	12.0
Greatest Breadth of Head.....	14.0
Distance from Axilla to Tip of Longest Finger.....	18.5
Distance from Vent to Tip of Longest Toe.....	51.5
Tibia	16.0

***Eleutherodactylus minutus*, new species**

DIAGNOSIS.—Closely allied to “Abbott’s Macito”¹ preserved specimens; distinguished from that species by their smaller size, more distinct dorso-lateral fold, their narrower head and blunter snout; the coloration alone is distinctive; side of the body below dorso-lateral fold mottled or spotted with dark brown, while in “Abbott’s Macito” the mottling is indefinite or at least does not form a dark dorso-lateral stripe posteriorly.

TYPE.—A. M. N. H. No. 11404; adult ♀; on ferns in dense palm thicket near Paso Bajito, Jarabacoa-Constanza Trail, Dominican Republic; September 4, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Head as long as broad, slightly narrower than body; distance between anterior corner of the eye and nostril less than the greatest diameter of the eye, about equal to the interorbital width; distance between the nostril and tip of the snout contained two times in the distance between nostril and eye; canthus rostralis very sharp, the loreal region concave; tympanum distinct; its diameter contained a little over two times in the diameter of the eye; separated from the eye by a space equal to three-fourths of its diameter. Tibio-tarsal joints of either side overlapping slightly when the legs are placed at right angles to the body; tibio-tarsal joint reaches the posterior border of the tympanum. Digital dilations very small, the discs equal to a third or a fourth the greatest diameter of the tympanum; digits free, second toe slightly longer than the first; no tarsal fold; vomerine teeth in two small, oblique groups far behind the choanæ and separated from each other by a wide space; tongue elliptical, unemarginate behind. Skin smooth above and below; a glandular dorso-lateral fold extending from the eye to lumbar region.

Ground tone above flesh-color to pale gray, ventral surfaces slightly paler; a stripe of dark brown extending from the nostrils along the canthus rostralis to eye, broadening out behind the eye to form a conspicuous supra-tympanic crescent, another stripe of dark brown extending along the dorso-lateral fold to anus, the stripe interrupted at a number of points; sides of the body immediately below the dorso-lateral fold mottled or spotted with dark brown; the lower half of the sides feebly stippled with brown, posterior surfaces of the thighs dark brown, a narrow white line running obliquely across each thigh and meeting its mate of the opposite side above the anus; posterior surfaces of the tibia washed with dark brown; two or three feebly indicated bars across the dorsal surfaces of the tibia.

¹This species was recently sent me through the kindness of Dr. W. L. Abbott, the collector. It is the commonest form of *Eleutherodactylus* in Santo Domingo. Dr. Abbott’s material is being described by Miss D. Cochran, of the U. S. National Museum, and it will not be long before a scientific name is available for the species.

MEASUREMENTS

Tip of Snout to Vent.....	17.5 mm.
Tip of Snout to Posterior Border of Tympanum.....	6.5
Greatest Breadth of Head.....	6.2
Distance from Axilla to Tip of Longest Finger.....	9.5
Distance from Vent to Tip of Longest Toe.....	25.0
Tibia.....	8.2

***Eleutherodactylus schmidti*¹ new species**

DIAGNOSIS.—Allied to *E. weinlandi* and *E. lentus* of the Dominican Republic and to *E. richmondi* of Porto Rico, but readily distinguished from these species by its coloration. Tibio-tarsal articulation marking anterior corner of eye or slightly beyond; discs of digits small; dorsal surface grayish brown, heavily marbled with dark brown; a light interorbital streak; two pale dorso-lateral stripes rarely present; under-surfaces of hind limbs bright salmon to pink.

TYPE.—A. M. N. H. No. 11405; adult ♀; among stones along stream bed, Lo Bracita, Prov. Pacificador, Dominican Republic; August 9, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Head as long as broad, slightly narrower than body; distance between anterior corner of eye and nostril slightly less than the greatest diameter of the eye, slightly greater than the interorbital width; distance between nostril and the tip of snout contained once and four-fifths times in the distance between nostril and eye; canthus rostralis rounded; loreal region moderately abrupt; tympanum distinct, its greatest diameter contained a trifle over two times in the greatest diameter of the eye, separated from the eye by a space equal to two-thirds its diameter. Tibio-tarsal joints of either side overlap slightly when the legs are placed at right angles to the body; tibio-tarsal joint reaches the anterior corner of the eye. Digital dilations small, the discs not greater than half the diameter of the eye; digits free; second toe much greater than the first; no tarsal fold. Vomerine teeth in two oblique series extending outward to the outer edge of the choanæ; vomerine teeth very close to choana, separated from them by less distance than separates the two vomerine series from each other; tongue large, slightly nicked behind. Skin finely granular above, the granules not forming distinct rows, ventral surfaces smooth.

Ground tone above pale brownish gray, heavily spotted and marbled with dark brown, the dark tone forming cross-bars on the limbs a pale interorbital stripe present and some indication of a semicircle above the anus. Ventral surface of body flesh-color, under surfaces of hind limbs salmon-color; throat, chest and sides of abdomen stippled and suffused with dark brown.

MEASUREMENTS

Tip of Snout to Vent.....	43.5 mm.
Tip of Snout to Posterior Border of Tympanum.....	16.0
Greatest Breadth of Head.....	16.0
Distance from Axilla to Tip of Longest Finger.....	26.0
Distance from Vent to Tip of Longest Toe.....	71.0
Tibia.....	22.0

¹Named in honor of Mr. Karl Patterson Schmidt, formerly associated with the American Museum but now in charge of Herpetology at the Field Museum of Natural History, Chicago.

Eleutherodactylus ruthen¹ new species

DIAGNOSIS.—Closely allied to *E. inoptatus* but readily distinguished from that species and all other West Indian frogs by its shovel-shaped snout; it further differs from *E. inoptatus* in its shorter head, shorter leg and more spotted dorsum.

TYPE.—A. M. N. H. No. 11406, adult ♂; Samaná, Dominican Republic; November 8, 1922; John King.

DESCRIPTION OF TYPE.—Head broader than long, slightly narrower than body; distance between nostril and eye slightly greater than the greatest diameter of the eye, equal to the interorbital width; distance between nostril and tip of snout contained less than twice in the distance between eye and nostril; snout pointed, produced into a shovel, the latter one-third the diameter of the eye; the shovel in profile forming a step with the rostrum proper; canthus rostralis sharp, loreal region concave and sloping gradually; tympanum distinct, its greatest diameter contained once and two-thirds in the greatest diameter of the eye, separated from the eye by a space equal to one-half its diameter. Tibio-tarsal joints of either side slightly overlap when the legs are folded at right angles to the body; tibio-tarsal joint reaches midway between eye and nostril. Digital dilations moderate, those of the manus about half the diameter of the tympanum, distinctly larger than those of the pes; digits free except for a slight indication of a web between the two outer toes; second toe slightly longer than the first, no tarsal fold. Vomerine teeth in two oblique series extending outward to the outer edge of the choana, separated from the choana by a short distance, which is about equal to the space separating the two series of vomerine teeth from each other; tongue large, slightly emarginate behind. Skin glandular and finely warty above, a dorso-lateral glandular fold, a supra-tympanic fold and an oblique fold on the side of the body; warts best developed on sides of body; periphery of the abdomen, and posterior faces of the thighs highly glandular.

Ground tone (in alcohol) a pale purplish gray or clay-color; a canthal stripe, an interorbital stripe, a supra-tympanic spot and two rows of large irregular spots on the back of a dark purplish brown; two cross-bars on the forearm, six on the thighs and three or four on the lower leg of the same color; upper surfaces suffused with a dark tone leaving pale rings of ground tone around many of the dark spots and bars; posterior surfaces of the thighs purplish brown spotted with gray or white; ventral surfaces whitish, throat, sides of abdomen, and thighs stippled with purplish brown.

MEASUREMENTS

Tip of Snout to Vent.....	49.0 mm.
Tip of Snout to Posterior Border of Tympanum.....	18.5
Greatest Breadth of Head.....	20.0
Distance from Axilla to Tip of Longest Finger.....	32.0
Distance from Vent to Tip of Longest Toe.....	79.0
Tibia.....	27.5

¹Named in honor of my wife, Mrs. Ruth Crosby Noble, who discovered this species and collected the first series of specimens, all now living in the "moss gardens" of The American Museum of Natural History.

AMERICAN MUSEUM NOVITATES

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THE SUPPOSED PLUMAGE OF THE EOCENE BIRD *DIATRYMA*

By T. D. A. COCKERELL

Plumage, the unique possession of birds, dates back to at least the Upper Jurassic. It is so well developed in the *Archæopteryx* of that era that we may reasonably expect to find it considerably earlier, should there exist a deposit capable of preserving recognizable traces of it. According to Petronievics, the specimens of supposed *Archæopteryx* in the British and Berlin Museums represent different genera, not merely species as Dames had maintained. It appears that the Berlin specimen must take the name *Archæornis siemensii* (Dames), and in certain characters it is said to approach the carinate type, while the British Museum example shows more ratite features. As the genus *Archæopteryx* was based by Meyer (1861) on a feather, it appears to be somewhat hazardous to identify it with one or another of the well-preserved forms and, according to the facts given by Lydekker ('Cat. Fossil Birds,' p. 362), the British Museum specimen seems to be entitled to the name *Griphosaurus problematicus*.

In the light of these facts, and in consideration of all we know about Mesozoic birds, we have little ground for considering any Tertiary or modern bird primitive on account of its lacking the power of flight or possessing hair-like feathers. Even in the Cretaceous, certain birds were so far advanced that Shufeldt has not hesitated to refer one of them (*Graculavus lentus* Marsh) to the modern genus *Pedioecetes*, judging from the distal end of a tarso-metarsus. In the heading of his account (Trans. Conn. Acad., XIX, p. 25) he actually calls it *P. phasianellus* (L.), but the true purport of the observations below would be better indicated by calling it *Pedioecetes* (?) *lentus*. As Matthew and Granger indicate, it is hardly to be doubted that the discovery of the whole skeleton would compel us to recognize a perfectly distinct genus. Nevertheless, modernization and differentiation had gone far by the time we come to the Eocene and, as regards the feathers, there was probably no striking advance remaining to be made. The promise of the future was rather in the development of the voice and in arboreal and nest-building adaptations and developments. Even the mechanism for maintaining a high temperature must have been already perfected.

In the midst of this rather orderly and consistent development certain extraordinary types appear, both in the living and extinct faunas. They do not represent the expectations of orthogenesis and must be regarded as specially adapted forms, made, like the caricatures of the cartoonist, by exaggerating certain features to the point of grotesqueness. Such a bird is the *Diatryma* of the Wasatch, fully elucidated from a magnificent specimen by Matthew and Granger (Bull. Amer. Mus. Nat. Hist., XXXVII, pp. 307-326). Of the four species ascribed to *Diatryma*, only *D. steini* is known by the major part of the skeleton. The others are represented by very imperfect fragments of the feet. Nothing has been known of the plumage but, although the authors (p. 309) suggest that the bird is closest to *Cariama*, the very convincing restoration by Mr. Erwin S. Christman (Pl. xxxiii) shows hair-like plumage like that of a cassowary.

The vicinity of Roan Creek in western Colorado has long been known to palæontologists on account of the discovery of numerous fossil insects, ascribed to the Green River Eocene. It is a region of high mesas or hills, separated by gigantic valleys, which have not yet been accurately mapped, topographically or geologically. The enormous exposures are all in the Eocene, apparently Wasatch at the bottom of the valleys and Green River at the top. Before going there I was prepared to believe that the shales ascribed to the Green River were not really contemporaneous with the typical beds in Wyoming; but the longer one worked in them the closer seemed to be the resemblance to the genuine Green River deposit, and no hesitation remains in ascribing the whole series to a single epoch. Granting this, it is of course still true that horizons will have to be elucidated and will probably show marked differences in their contents. The good fossiliferous levels in the Roan Mountains are high up, but some distance below the tops of the mesas. In certain places they are indeed on top, but this occurs on spurs from the main elevations which have been worn down to a lower level. The fossil-bearing beds are known as the oil shales, and the hard gray rock will burst into flame when placed on a fire. At very numerous places assessment holes have been dug and, although it is doubtful whether the money thus invested will be recovered, the palæontologist finds most of his heavy work done for him and has only to pick up and split the shale upon the dumps. Now indeed is the golden time to collect fossils in this area, as in five years' time the exposed shales will have crumbled to dust and it is not probable that the digging of holes will continue indefinitely.



Fig. 1. Feathers from the Eocene.

A, Contour feather of unknown bird.

B, C, Plumage of *Diatryma* (?) *filifera*.

Passing up the old Ute trail above Seller's Ranch, a mile or more before reaching the Osborn cabin, there is a considerable excavation which we designated Station No. 1. The holes, blasted out in successive years, are like so many gigantic steps on the side of the mountain, the uppermost practically on the top. Later on it will be possible to describe

the fossil insects and plants taken from this location. Among other things, we found a typical contour feather of a bird, perhaps the oldest ordinary feather known (Fig. 1). At the lowest hole, which was in general unproductive, Mrs. Cockerell was so fortunate as to find long strands of plumage which look as if they might have come from the very *Diatryma* figured by Mr. Christman. Repeated study, with lens and microscope, shows that they are not vegetable fibres, nor are they mammalian hairs. They are not filoplumes, according to Chandler's ('A Study of the Structure of Feathers, with Reference to their Taxonomic Significance,' Univ. of Calif. Publ., Zoöl., 1916) definition, but are like the very slender simple feathers of the Casuariformes, particularly the cassowary. Chandler says of the cassowary:

The naked terminal portion of the feather, which sometimes constitutes three-fourths of the entire feather and reaches a length of over 20 cm., sometimes has the stiff bristle-like naked barbs present in decreasing numbers all the way to the tip, where there are only two or three per centimeter on each side, while in other cases, especially in shorter feathers, the naked shaft is produced as a very coarse, stiff bristle.

The fossil plumage now described had a length of fully 20 cm., probably much more. It was apparently very dark, appearing black upon the stone. It was soft and wavy, not bristly. All the filaments appear to be perfectly simple. The average filament has a diameter of about $65\ \mu$; but there also occur slender, pale brown ones only half as wide. The surface mottling resembles that in Chandler's figure of *Casuaris*. In places the filaments are bent instead of curved. There is no resemblance to the plumage of *Cariama*, but, as compared with the cassowary, the plumage seems to have been even more filiform, more delicate and soft, less bristly.

Among the known Eocene birds, this could only have come from *Diatryma*. The horizon is considerably higher than any known for that genus and no doubt a different species, at least, is concerned. Until we know more about the matter, this plumage may be designated *Diatryma* (?) **filifera**, new species.

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NOTES ON WEST INDIAN LAMPYRIDÆ AND CANTHARIDÆ (COLEOPTERA) WITH DESCRIPTIONS OF NEW FORMS

BY ANDREW J. MUTCHLER

In Novitates-No. 60, footnote on page 2, I remarked that I had in hand records of Lampyridæ belonging to the genera *Photinus* and *Photuris* and some species of Cantharidæ. These records, now ready for publication, include specimens received from the following sources: British Museum, sent by Mr. G. J. Arrow; Mr. Geo. N. Wolcott of the Insular Experiment Station at Rio Piedras, Porto Rico; University of Iowa, sent by Dr. Dayton Stoner; Estacion Experimental Agronomica, Santiago de las Vegas, Cuba, sent by Mr. Stephen C. Bruner, Chief of the Department of Entomology and Vegetable Pathology; also a number from Haiti, collected by Mr. F. E. Watson of this Museum, whose expedition to that part of the Island of Hispaniola was made possible through the generosity of Mr. B. Preston Clark.

Lampyridæ

Photinus pallens (Fabricius)

JAMAICA: without any definite locality; Coll. British Museum.

Photinus heterodoxus Leng and Mutchler

Two specimens of this species, in the collection of the Insular Experiment Station of Porto Rico, which are merely labeled "Porto Rico," differ slightly from the type. One of the specimens has a somewhat well-defined brown spot on the disk of the pronotum, which extends from the base to about the apical third. The elytra in both specimens are somewhat darker. The basal abdominal segments are darker and the apical ones are not waxy white.

Photinus ceratus Leng and Mutchler

JAMAICA: no definite locality; Coll. British Museum.

Photinus glaucus (G. A. Olivier)

CUBA: Sierra Maestra, July 10-20, alt. 3600 to 4300 feet (C. H. Ballou and S. C. Bruner); Coll. Estacion Exp. Agronomica, Santiago de las Vegas, Cuba.

The three specimens from Cuba which I have seen do not agree in every respect with those from Jamaica. Further study with a larger series may show sufficient differences to require them to be separated from *glaucus*.

***Photinus lutzi* Leng and Mutchler**

DOMINICA: Laion (G. A. Ramage); Coll. British Museum.

***Photinus dubiosus* Leng and Mutchler**

PORTO RICO: Larres, March 7 (F. Sein); Rio Piedras, April 5 (Geo. N. Wolcott); Coll. Insular Exp. Sta., Rio Piedras, Porto Rico.

***Photinus pygmæus* E. Olivier**

CUBA: Sierra Maestra, alt. 3000 to 4200 feet, July 10-20; Pico Turquino, alt. 3500 feet, and summit,¹ July 20 and 22; and Nagua Oriente, July 7 (S. C. Bruner and C. H. Ballou); Camagüey, July to August (J. Acuna); Coll. Amer. Mus. Nat. Hist. and Coll. Estacion Exp. Agronomica, Cuba.

There are thirteen specimens among the above material received from Mr. S. C. Bruner which I have identified as this species. These specimens range from brownish black to deep black in color and are from 3 to 6.5 mm. in length.

***Photinus lengi*,² new species**

Figure 1

MALE.—Elongate. Head black, somewhat deeply depressed between the eyes. Mandibles brown, darker on inner margin. Antennæ black, longer than the head and thorax. Pronotum testaceous, thinly clad with moderately long, yellow pubescence, disk rosy with more or less defined darker spots or markings; margins somewhat coarsely but not very closely punctate, disk less coarsely punctate. Scutellum yellow, more or less rosy at base. Elytra covering the abdomen, dark brown bordered except at base with pale yellow, somewhat closely punctate and covered with a short yellow pubescence, lateral margins somewhat broadly flattened. Underside reddish yellow. Metasternal episternum wholly, and sides of metasternum narrowly fuscous, first to fourth ventral segments of the abdomen more or less broadly darkened through the central portion, fifth and sixth black, seventh with waxy white light organs at the

¹There are several specimens among the material sent by Mr. S. C. Bruner which are marked "Cumbre" (Summit) when referring to altitude. All specimens so marked are from Pico Turquino, the summit of which, according to published records, is approximately 2400 meters (about 7800 feet) above sea-level.

²Dedicated to my good friend and co-worker, Mr. Chas. W. Leng, senior author of our work on the 'Lycide, Lampyridæ, and Cantharide (Telephoridæ) of the West Indies,' to whom I am indebted for many favors and also for his kindness in reading the manuscript and checking up the new species included in this and my former paper.

basal part, apex of seventh and the small eighth segment dark. Femora yellow. Tibiæ and tarsi darker. Length, 8.5 to 10.5 mm.

FEMALE.—Head broad and feebly depressed between the eyes. Pronotum yellow, disk yellow with dark central spot. Scutellum wholly yellow. Elytra about one-half as long as the abdomen, leaving four dorsal segments fully, and the greater part of a fifth, uncovered. Exposed dorsal segments of the abdomen with a median costa, first three exposed segments becoming gradually darker, the two apical ones black. Underside yellow; metasternal episternum black; apical three segments of the abdomen darker, last segment with a pair of waxy white, light organs at the base, otherwise as in the male. Length, 11.5 mm.

HAITI: Holotype male, No. 26979, and allotype female, No. 26980, Port au Prince (at light), December 22 to 31, 1921. Paratypes male and female, Nos. 26981 and 26982, Port au Prince (at light), December 22, 1921 to April 11, 1922 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

The males of this species, at a superficial glance, resemble some specimens of *quadrinaculatus* but on examination they will be found to have the pale margins (especially the lateral ones) of the same width throughout, also the general color of the paler portions of the elytra whitish yellow. There are also two male specimens in the type lot in which the dark color on the disk of the elytra, behind the scutellum, is not fully developed, making the suture appear broadly margined basally; in these same specimens the dark spot on the disk of the thorax is barely perceptible, there being merely a dusky mark to indicate the spot. The two female paratypes seem to have just emerged (before capture) from the pupal shell as none of the darker colors are as well developed as in the allotype.

The species should be placed in the Pantoni group near *pantoni* and *suavis*.

Photinus magnus, new species

Elongate. Front of head light brown, somewhat deeply excavated between the eyes in the male, moderately impressed in the female, punctate and covered with a light brown pubescence. Mandibles pale yellowish brown at base, apex black. Palpi pubescent with an intermixture of longer hairs, black, apical joint with a streak of light brown at each side. Antennæ reaching about to the hind coxæ, black, pubescence moderately long and somewhat coarse. Pronotum somewhat broadly rounded in front, subapical and sublateral margins depressed, the sublateral being much more deeply so in the male than in female, somewhat coarsely punctate; pubescence very short, pale yellow with a few scattered black hairs; disk rosy, with darker spots. **Male** with a large dark spot on the middle of the disk, longitudinally divided at the

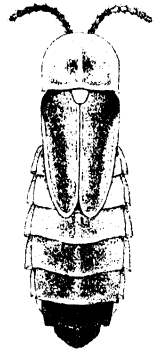


Fig. 1. *Photinus lengi*, new species. Female allotype.

base to about the apical third by the rosy color in the holotype, almost completely divided in the paratype, and with two minute dark spots on each side at the base, the inner spots paler than the outer ones. Female with four spots on the middle of disk, the two front ones smaller and paler in color than the two hinder ones, basal spots similar to those in the male. Scutellum pale yellow, coarsely punctate and pubescent. Elytra smoky black, moderately coarsely punctate and covered with a short, pale yellow pubescence, margined at the sides and suture with pale yellow; apex very vaguely margined. Underside yellow, more or less marked with dark brown in the holotype and allotype, brownish black in the paratype. Female with the apex and sides of the first to fifth ventral segments of the abdomen more or less black at the sides and apex, sixth wholly black, seventh with a waxy white spot at each side of the base and with a pale-colored longitudinal line through the center. Male with the sides and apex of the four basal segments very narrowly darker in the holotype, only slightly paler basally in the paratype, fifth and sixth black, seventh waxy white, small eighth yellowish brown. Legs yellow, apex of femora, inner margin of tibiae and all of tarsi brown. Length, male 14.5 mm., female 16.5 mm.

CUBA: Holotype male, No. 26983, and allotype female, No. 26984, Sierra Maestra, alt. 4500 feet, July 10-20, 1922 (C. H. Ballou and S. C. Bruner); Coll. Amer. Mus. Nat. Hist. Paratype male, Sierra Maestra, July 10-20, alt. 3600-4200 feet (C. H. Ballou and S. C. Bruner); Coll. Estacion Exp. Agronomica, Cuba.

***Photinus magnus* variety *turquino*, new variety**

MALE.—Form slightly more elongate. Center of the impressed front part of the head black, sides and apex margined with rosy color. Pronotum with only one large, central, squarely outlined black spot which has the basal center longitudinally divided by a narrow pale line. Elytra dark with pale margins continuous around the apex. Underside brownish black, seventh segment waxy white at base and sides. Otherwise as in the species.

FEMALE.—Unknown.

CUBA: Holotype, No. 26985, Summit of Pico Turquino, July 2, 1922 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

***Photinus unicus*, new species**

MALE.—Oblong elongate. Head very moderately excavated between the eyes, yellow. Palpi yellowish brown. Antennae dark brown, about one-half as long as the body. Pronotum yellow, moderately broadly rounded at apex, submargins slightly impressed, disk with a longitudinal depression at basal half. Scutellum yellow. Elytra brownish black, margined, except at base, with yellow; sutural and apical margins narrower than the lateral. Underside dark brown, last two (including the small eighth) ventral segments of the abdomen whitish yellow. Legs brown, marked with paler color. Length, 5 mm.

FEMALE.—Unknown.

JAMAICA: Holotype; Coll. British Museum.

This species differs from all of the others from Jamaica, which have the elytra margined with paler color, in having the thorax of a uniform

pale color. In general appearance it resembles *apoplecticus* and *simplex*. It differs from *apoplecticus* in the form of the pronotum which is much more elongate and broader in *apoplecticus*. The antennæ also differ, they being shorter in *apoplecticus* than in this species. The species differs from *simplex* in the following respects: the antennæ are longer and the basal joint is not testaceous; the disk of the thorax is not rosy; the apical pale margin of the elytra is much narrower; the body beneath is darker in color; and the apex of the pronotum is less broadly rounded.

Photinus simplex (E. Olivier)

DOMINICA: Laudat, March 30; Coll. British Museum.

Photinus nefarius (E. Olivier)

CUBA: Nagua Oriente, July 7 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Nagua Oriente, July 7 and Yara, July 5 (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

Photinus quadrimaculatus (Castelnau)

SANTO DOMINGO: no definite locality; Coll. British Museum. DOMINICAN REPUBLIC: Haina (Geo. N. Wolcott). HAITI: Port au Prince (at light), December 22, 1921 to March 29, 1922; Fond Parisien, February 11-18, and Aux Cayes (at light), March 15-20 (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

The five male and eleven female specimens which are before me show a marked variation in the elytral markings. The black color on the disk of the elytra in many of the specimens forms a continuous line narrowed toward the middle and extending from the base to near the apical margin. In some this line is almost separated at the middle of the elytra, thus making the apical and basal parts appear darker. There is also a specimen in which the black color is barely noticeable at the base but is very prominent and forms a black spot near the apex of each elytron, and another which has the discal black markings covering the apical margins of the elytra.

Photinus commissus E. Olivier

JAMAICA: no definite locality; Coll. British Museum.

The three specimens of this species which were received from Mr. G. J. Arrow of the British Museum are an extremely dark form of *commissus*. They have the disk of the pronotum darker and the elytra

blackish brown, leaving the outer apical margin pale. There is also a pale spot on the basal third and on the apical half of each elytron. In one of the specimens these spots are fairly large, in another they are quite small, and in a third they are scarcely discernible.

***Photinus discoideus* (Sahlberg)**

One specimen of this species in British Museum Collection, labeled "West Indies," is probably from Guadeloupe, as there are no records of the species being found in any of the other islands.

***Photinus limbipennis* Jacquelin Duval**

CUBA: Camagüey, December 29 (J. Acuna); Coll. Amer. Mus. Nat. Hist. and Coll. Estacion Exp. Agronomica, Cuba.

***Photinus sublateralis*, new species**

MALE.—Elongate oval. Head, between the eyes, black, very feebly excavated. Mandibles brown. Palpi with the two apical joints black, basal joints generally light brown. Antennæ about one-half as long as the body, dark brown, somewhat densely pubescent. Pronotum moderately broadly rounded at apex, basal angles acute, submargins depressed, somewhat coarsely but not closely punctate, lateral margins yellow, apical dusky; disk with a median longitudinal depression which extends from the base to slightly beyond the middle; rosy red, with a longitudinal dark mark which is narrow at the base and gradually broadens to apex. Scutellum dark brown. Elytra brown, slightly darker basally, broadly expanded at the basal two-thirds, closely punctate and covered with a short pubescence; margined with yellow, narrowly at the suture, more or less distinctly at the apex, moderately broadly at basal two-thirds of the lateral margins where the elytra are dilated. The extreme outer edges of the elytra are dark brown. Thorax beneath, rosy red. Underside of body blackish brown, except the two apical (including the eighth) segments of the abdomen which are pale brown. Legs varying from pale to dark brown. Length, 9.5–10.5 mm.

FEMALE.—Unknown.

CUBA: Holotype, No. 26986, and paratype, No. 26987, Pico Turquino, alt. 5500 to 6500 ft., July 20, 1922 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Five paratypes, Pico Turquino, July 20 and 22, alt. 5000 to 5500 ft., and summit (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

This species differs from any West Indian species in having the outer edge of the lateral pale margin of the elytra bordered with a darker color. One of the paratype specimens does not agree in every respect with the holotype. The disk of the pronotum is not as bright rosy red and the basal part of the black marking is merely indicated by black hairs. The pale margins of the elytra in some of the specimens are more or less disconnected at the apex. I believe the specimens represent one species.

Photinus vittatus (G. A. Olivier)

PORTO RICO: Guanica, December 10; Rio Piedras, March 23; Tao Alta, January 1; and La Plata, June 11 (Geo. N. Wolcott); Coll. Insular Exp. Sta., Rio Piedras, Porto Rico.

Photuris brunnipennis Jacquelin Duval

CUBA: Taco Taco, April 1-6 (S. C. Bruner, J. Acuna and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Taco Taco, April 1-6 (S. C. Bruner and C. H. Ballou); Santiago de las Vegas, October 31 (B. T. Barreto); Habana, January 20 (J. Acuna); Baracoa, April 19 (P. Cardini); Coll. Estacion Experimental Agronomica, Cuba.

The specimen from Santiago de las Vegas has lost all trace of the paler elytral margins but otherwise agrees with the description of *brunnipennis*.

Photuris jamaicensis E. Olivier

JAMAICA: Trouthall, Clarendon, November 17 (A. H. Ritchie); Coll. British Museum.

The specimen which I have identified as this species is much discolored, but I believe it to be *jamaicensis*.

Cantharidæ**Belotus cacumenum**, new species

Elongate. Head reddish yellow, with inconspicuous cloudy spots on the vertex, apex of labrum margined with black; moderately finely and somewhat closely punctate, covered with a short yellowish pubescence. Mandibles somewhat long with a broad triangular tooth on the middle. Palpi blackish brown, last joint moderately stout. Antennæ black, arising from frontal bosses, nearly as long as the body, moderately serrate; extreme base of the basal joint paler. Pronotum reddish yellow, somewhat finely and moderately closely punctate, subquadrate, somewhat longer through the middle line than at the sides; disk with a transverse impression at the base. Scutellum reddish yellow, apex arcuately emarginate. Elytra nearly two-thirds as long as the body black, somewhat shiny; each elytron with two, more or less obsolete, discal carina, the basal parts of which are joined together in a curve and begin on the basal center a short distance behind the base and extend obliquely to about the apical third; disk coarsely wrinkled punctate; extreme base and apical third finely wrinkled punctate; pubescence short, brown. Head and thorax beneath reddish yellow. Body beneath dark brown to black. Legs blackish brown covered with paler brown pubescence. Coxæ and trochanters pale yellow. Length, 5 mm.

CUBA: Holotype male?, No. 26988, Pico Turquino (Summit), alt. 6620 ft., July 20, 1922 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist.

***Belotus balloui*, new species**

Elongate. Head reddish yellow with a faint dark V-shaped mark which extends from slightly in front of the middle of each eye to the center of the basal margin in the holotype, front of head black in the paratype; granulate punctate and covered with a short whitish pubescence. Palpi with the last joint moderately stout; antennæ arising from frontal bosses, moderately serrate, black, base of first joint yellow; second joint slightly more than one-half as long as the third; third and following joints approximately equal in length. Pronotum reddish yellow, punctate, pubescent, broader than long, rectangular, slightly longer at the middle line than at the sides. Elytra rather indefinitely wrinkled punctate, about one-half as long as the abdomen, brownish black, margined at the suture with yellow and, in the holotype, narrowly yellow on the side margins. The sutural pale margins extend to the base in the holotype; only to the apex of scutellum in the paratype, those on the sides of the holotype are post-humeral. Body beneath black, except central portion of prosternum, apex of metasternum, and apical ventral segments of the abdomen, which are yellowish, abdominal segments margined at the sides with yellow in the paratype. Legs yellowish, base of femora, tibiae and tarsi on first two pair somewhat darker, hind pair with base of femora, apex of tibiae and tarsi only slightly darker. Length, 6 mm.

CUBA: Holotype, male?, No. 26989, Palma Mocha, Sierra Maestra, July 10-20, 1922, alt. 3500 to 4400 ft., (C. H. Ballou and S. C. Bruner); Coll. Amer. Mus. Nat. Hist. Paratype, Palma Mocha, Sierra Maestra, July 10-20, alt. 3500 to 4000 ft., (C. H. Ballou and S. C. Bruner); Coll. Estacion Exp. Agronomica, Cuba.

The two specimens from which this species was described do not agree in every respect as to color markings. The one which I have marked as paratype has the front of the head dark; the sutural pale margin of the elytra does not extend to the base and the outer margins are not bordered with paler color; the abdominal segments have the lateral margins bordered with pale yellow and the apical abdominal segments are not pale yellow. I believe they represent one species, as I can find no structural differences on which to separate them.

***Tytthonyx marginicollis*, new species**

MALE.—Elongate, shining. Upper part of head, from base to between the antennæ, blackish gray; sides, front, and underneath pale yellow. Mandibles somewhat long, with a moderately large triangular tooth on the inner side of the middle; pale yellow, apex and tooth slightly darker. Labial palpi moderately long, pale yellow, apical joint darker. Antennæ about two-thirds as long as the body, somewhat strongly serrate, light brown, pale beneath, basal joint club-shaped, second joint broad at apex, joints three to eleven gradually diminishing in thickness and gradually increasing in length. Pronotum blackish gray, margined at the apical angles, sides, basal angles and basal center with pale yellow, apical and basal angles broadly rounded; somewhat finely punctate, pubescence light brown, disk impressed somewhat broadly at the apical sides and basal center, apical center more narrowly longitudinally impressed. Scutellum pale yellowish, apex squarely truncate. Elytra less than one-half the length of the body, dehiscent, rounded at apex, slightly paler than the thorax

in color. Underside pale yellow. Last ventral segment completely divided, penultimate segment deeply arcuately emarginate, the two segments forming together an elongate cavity in which the genitalia lie. Legs yellow, apex of tibiae and tarsi slightly darker. Length, 3 to 4.25 mm.

FEMALE.—Unknown.

ANTIGUA: Holotype, No. 26990; Coll. Amer. Mus. Nat. Hist. One paratype; Coll. University of Iowa. Both specimens collected June 18.

Tytthonyx discolor Leng and Mutchler

PORTO RICO: Larres? Coll. Insular Exp. Sta., Rio Piedras, Porto Rico.

Silis marginella Jacquelin Duval

CUBA: Viñales, April 6–9; Camagüey, July to August (S. C. Bruner and J. Acuna); Coll. Amer. Mus. Nat. Hist. Camagüey, July to August; Taco Taco, April 1–6 (S. C. Bruner, J. Acuna and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

Silis (Haplacroselis) impressa (Pic)

CUBA: near Pico Turquino, alt. 4500 ft., July 20 (S. C. Bruner and C. H. Ballou); Coll. Amer. Mus. Nat. Hist. Pico Turquino, July 20, alt. 4500–5500 ft., (S. C. Bruner and C. H. Ballou); Coll. Estacion Exp. Agronomica, Cuba.

Tylocerus coriaceus Leng and Mutchler

HAITI: Port au Prince, January 15 to March 21 (at light) and Petionville, January 25 to 29 (at light). (F. E. Watson); Coll. Amer. Mus. Nat. Hist.

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FOUR NEW LIZARDS FROM BEATA ISLAND, DOMINICAN REPUBLIC

By G. K. NOBLE

This is the second paper to appear dealing with the results of the "Angelo Heilprin Expedition to the Dominican Republic." While investigating the life history of the Rhinoceros Iguana, *Cyclura cornuta* (Bonnaterre), I spent four days (October 1 to 4 inclusive) on Beata Island off the southwestern coast of the Dominican Republic. As no reptiles had previously been recorded from Beata, I made an effort to secure a representative collection. The four species described below were recognized in the field as distinct from their relatives on the mainland (Dominican Republic).

The four species include only a part of the herpetological fauna of Beata Island. In a subsequent paper I shall discuss the fauna as a whole and compare it with that of the mainland. It may be mentioned here that all the reptiles of the island have been derived from stocks existing today in the arid southwestern part of the Dominican Republic. The species described below are represented in the collection by a series.

Ameiva abbotti,¹ new species

DIAGNOSIS.—A brilliantly colored lizard closely related to *A. chrysolaema*; agreeing with that species in its straight-keeled caudal scales, its four supraoculars, and its ten rows of ventral scales; differing from *A. chrysolaema* in having the prefrontals more broadly in contact, the frontal in contact with the third ocular, or separated by a row of small scales. The preaxial row of antibrachials and the brachials small, femoral pores more than twenty. Differing from *A. chrysolaema* and all other species of the genus in its coloration: dorsal surface of head olive-brown, of body black or very dark brown mottled with black; a series of large spots (1 to 3 mm. in diameter) forming about 12 to 18 longitudinal rows extending from the occiput to the base of the tail; the spots bluish or whitish above, bluish on the sides of the body and bright blue along the periphery of the abdomen; gular region and venter rosy pink; a broad band of black across the throat and chest, fading gradually into the pink of the abdomen. In life the dorsal spots greenish, the lateral ones bright blue in striking contrast to the black ground-tone of the back, the chestnut head and the rosy venter. Young with the distal part of the tail pale clay-color to white.

¹I take pleasure in naming this *Ameiva*, probably the most attractive toid in the West Indian region, after the naturalist, Dr. W. L. Abbott, whose intimate knowledge of the Dominican Republic contributed greatly to the success of the expedition.

TYPE.—A. M. N. H. No. 24327; adult male; Beata Island, Dominican Republic; October 3, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Rostral forming an acute angle behind; nostril on the posterior part of anterior nasal; anterior nasals narrowly in contact behind rostral; fronto-nasal as wide as long, broadly in contact with the loreal; prefrontals broadly in contact, their suture nearly half the length of either prefrontal; frontal in contact with the first, second, and third supraoculars of each side; four supraoculars, the last half the size of the first; fronto-parietals separated from the third supraocular by one or two rows of granules; nine supraciliaries on one side, eleven on the other; these separated from the three posterior supraoculars by two rows of granules; the anterior granules enlarged and partly separating the first supraocular from the second; five occipitals, the median larger than the two outer but smaller than the two adjacent scales; two to three rows of post-occipitals; six enlarged upper labials to the middle of the eye, five enlarged lower labials to the same point; between lower labials and chin shields a wedge of small scales extending anteriorly to the post-mental. Chin and throat covered with granular scales; of these the largest do not form a band across the middle but form three indistinct patches, the median patch not as extensive as the two lateral ones; collar with three rows of only slightly enlarged scales.

Dorsal scales minute, granular, uniform; ventral scales in ten longitudinal rows (not including the outer row of half size or smaller plates¹) and thirty-six transverse rows; preanal plates in a triangle three rows high and seven scales broad at the base. Antebrachials in one row of large scales and two series of smaller scales on the preaxial side; brachials in three to four rows of small scales, these not larger than the small antibrachials; antibrachials and brachials not forming a continuous series but interrupted by many rows of granules; under side of thighs covered with six or seven series of hexagonal plates, the anterior largest; twenty-one to twenty-two femoral pores on a side; ventral surface of tibia with three rows of plates, the preaxials three times as wide as the postaxials, first (preaxial) toe distinctly shorter than the fifth; forty-two scales around the tail at the fifteenth ring.

Ground-tone above and on the sides black, fading to olive on the neck; head chestnut-olive; sixteen rows of large blue spots extending from neck to groin, five rows of whitish spots of the same size on the hind legs, numerous white spots on the tail; throat and abdomen rosy except where the blue spots encroach upon the periphery; collar, chest, and ventral surfaces of the forelegs black; ventral surface of the tail whitish, indistinctly spotted with brown.

Length, 287 mm. (tail reproduced); body, 116 mm.; arm, 44 mm.; leg, 83.5 mm.; head-length, 35 mm.; head-breadth, 19 mm.

***Ameiva beatensis*, new species**

DIAGNOSIS. — Closely related to *Ameiva lineolata* Duméril and Bibron, with which it agrees in its small size, smooth oblique caudal scales, and conspicuously striped dorsum. Distinguished from that species by its different color pattern: only six white stripes in the occipital region, four of these stripes continued to the tip of the snout; appendages and tail much bluer. Adult specimens larger than adult A.

¹This method of counting is that employed by Barbour and Noble, 1915, *Bull. Mus. Comp. Zool.*, LIX, pp. 417-479, but not by some others.

lineolata, the outer row of ventral plates much larger than in that species; other less conspicuous differences in the larger anterior chin scales, somewhat different preanals and tibials. In some of these characters, such as the reduction in the number of stripes and the pattern continued to the tip of the snout, this species approaches *A. wetmorei* of Porto Rico.

TYPE.—A. M. N. H. No. 24328; adult male; Beata Island, Dominican Republic; October 3, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Nostril between two nasals; anterior nasals broadly in contact behind rostral; fronto-nasal broader than long, in contact with the loreal; supraoculars four; frontal in contact with the first three supraoculars; a pair of small fronto-parietals broadly in contact with the third supraocular; five large occipitals and two smaller post-occipitals; the median occipital approximately the same size as the two adjacent ones; two outer occipitals of each side separated from the supraoculars by a row of small scales; seven supraciliaries, the first largest and in contact with the loreal; supraciliaries separated from the supraoculars by a single row of small scales; five supralabials to the middle of the eye, the first in contact with the nasals only; five infralabials to the middle of the eye; a mental, a postmental and five pairs of large chin shields, the first pair fully in contact, the second pair in contact for about one-third their length; between chin shields and infralabials a row of small scales extending as far forward as the loreal; chin and throat covered with small scales, those on the anterior half of the throat twice as large as those on the posterior half; collar with five rows of enlarged scales, the scales of the three medial rows nearly twice as large as the largest throat scales.

Back, sides, and upper surfaces of the limbs covered with numerous small roundish scales, some of these angular, subhexagonal; the medial scales no larger than those immediately adjacent to them; ventral side of the body with eight longitudinal rows of scales and an outer incomplete row; the largest scales of this outer row having one-third to half the area of the abdominal scutes adjacent to them; abdominal scales forming thirty-four transverse rows; preanal plates in a transverse and a longitudinal row, the three medial scales much the largest and forming a triangle, the anterior of these three scales much larger than the two posterior ones; on the lower arm two rows of antebrachials of which the outer is enormous, at least three times as broad as the inner row; on the upper arm two rows of brachials, the anterior series three times as broad as the posterior; brachials and antebrachials forming a continuous series, not interrupted by small scales. Under side of the thigh covered with six rows of scales, the postaxial much smaller than the preaxial, but grading into the latter; fifteen or sixteen femoral pores to each femur; tibial shields in three rows, the second or larger postaxial series from one-third to one-half the size of the enormous scales in the first (preaxial) series; first (preaxial) toe extending not quite as far as the fifth (postaxial) one; scales of the tail smooth, oblique except for the medial series above and below, these median scales wedge-shaped; eighteen scales in the fifteenth ring from the base of the tail.

Ground-tone (in alcohol) jet-black above with a series of narrow white stripes extending from the extreme tip of the snout to about half the length of the tail; nine of these stripes in the pelvic region (not counting the white flanks), these converging anteriorly to form only six across the occiput and sides of the head, and only three anterior to the eye on the top of the head; the medial stripe of the pelvic region disappears at a point not one-third the distance to the anterior legs; the two adjacent

stripes converge just behind the shoulders to form a single stripe, and this stripe disappears just anterior to the shoulders; the two stripes adjacent to this median stripe of the shoulder region converge just anterior to the frontal plate, while the two outer stripes of either side extend to the tip of the snout; ventral surfaces white, tinged with blue; tail and appendages tinged both above and below with bright ultramarine blue.

Length, 177 mm.; body, 57 mm.; arm, 19 mm.; leg, 37 mm.; head-length, 15 mm.; head-breadth, 8.5 mm.

***Anolis longitibialis*, new species**

DIAGNOSIS.—Closely allied to *Anolis cybotes* Cope, from which it differs in its much longer hind limb; its larger dorsal scales; its double series of enlarged medial scales; its supraorbitals separated from the supraorbital semicircular. Its coloration alone is distinctive; the fine penciling of dark brown not found in *A. cybotes*, nor the bright dewlap (which, oddly enough, sometimes retains its color in preservative).

TYPE.—A. M. N. H. No. 24329; adult male; Beata Island, Dominican Republic; October 3, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Habitus slender; body slightly compressed; head large with sharp canthus; snout broad but not depressed; tibio-tarsal articulation reaching nearly to the ear opening; tail compressed with a dorsal keel of short, pointed, backwardly directed scales; a low nuchal crest.

Head scales mostly smooth, some faintly keeled; four sharply edged canthal scales (not including the first long scale over the eye); one plate of the broad supra-orbital semicircles of each side in contact, the other plates separated from their mates of the opposite side by a single row of small scales; supraorbital semicircle separated from the occipital plate by one or two rows of scales; separated from the supraorbitals by one row of small scales. Occipital plate small; about as large as the ear opening; scales of the frontal region small, about as large as supraorbitals; frontal ridge faint; nine enlarged supraorbitals, all distinctly keeled; two rows of scales under the orbit parallel to the labials; five rows between canthal scales and labials at the widest point of the loreal region; six upper and six lower labials to the mid-point of the eye.

Dorsal scales small but larger than in *A. cybotes*; about one-fourth as large as the ventrals, which are smooth or swollen but not keeled, two rows of enlarged scales extending from occiput to caudal crest; a small, but well-defined, fleshy nuchal fold; tail with keeled scales and a low crest; seventeen scales around the tail at its mid-point; two enlarged postanals and one smaller one on either side. Limbs covered with enlarged scales on their postaxial sides, except on the tibia where the enlarged scales cover the ventral surface; a large dewlap extending posteriorly beyond the coracoid region.

Color (in alcohol) pale chocolate-brown above, finely marked with a number of narrow lines of dark brown; of these fine lines, the most conspicuous are one across the occiput, one behind the eye, and several short but longitudinally directed ones on the sides of the body; two or three transverse bars cross the back, the most anterior of which is widened out into a blotch; the dark tone forms about ten ill-defined rings on the tail; ventral surface dirty white, the throat region dusky; expanded dewlap yellowish.

Length, 198 mm.; body, 66 mm.; arm, 33 mm.; leg, 56 mm.; head-length, 23 mm.; head-breadth, 14 mm.

***Leiocephalus beatanus*, new species**

DIAGNOSIS.—Very closely allied to *Leiocephalus barahonensis* Schmidt, from which it differs only slightly in scutellation. It possesses one less supraocular than that species, and the medial shields of the snout are proportionately larger, making contacts between the adjacent plates different than those found in *L. barahonensis*. Very different from *L. barahonensis* in its large size and coloration; color pattern somewhat the same in both species, except for the striping; young, unlike the immature *L. barahonensis*, are brown above with four longitudinal stripes of white in addition to the one on the lower flanks, older specimens become iridescent green above and the two median stripes disappear; the bright reddish tail and hind limbs, as well as the cross-banded, not mottled throat, are equally distinctive features; the bright yellow abdomen of the adult male is not found in *L. barahonensis*.

TYPE.—A. M. N. H. No. 24330; adult male; Beata Island, Dominican Republic; October 3, 1922; G. K. Noble.

DESCRIPTION OF TYPE.—Head shields large, ridged; on the crests of these ridges a series of fine sense pores; three scales between the rostral and the first supraocular; a pair of frontals, a pair of prefrontals, and a pair of supranasals embracing a medial series of three scales; the second medial very large and preventing the prefrontal from making contact with its mate of the opposite side, the anterior and posterior medial scales small; frontals and prefrontals separated from the canthal scales by an elongate rhomboidal scale; three supraorbitals on one side, four on the other; seven supraoculars on each side, the first very small; a small occipital bordered anteriorly by two narrow parietals; four parietals in all, the outer pair three times as broad as the inner pair; all head shields ridged; the supraoculars and parietals most distinctly; six to ten ridges on the larger scales; four upper and five lower labials to the middle of the eye. Dorsal and lateral scales sharply keeled, mucronate; ventral scales smooth with denticulated edge; about forty-one scales around the middle of the body; scales of the neck like the dorsals; scales behind ear keeled and imbricate, not granular; dorsal and caudal crests low.

Color (in alcohol) iridescent green above, with two pale dorso-lateral stripes becoming whitish in the shoulder and neck region, some indication of two additional pale stripes between these, but extending only half the length of the body; sides of the head and body below dorso-lateral stripe a dark brown, a whitish stripe on the lower part of the flanks extending from shoulder to groin; dorsal surface of the head dull brown; upper surfaces, sides, and ventral surfaces of posterior limbs and tail a reddish brown; this color much paler below than above. Ventral surface of throat and chest whitish or bluish, marked with seven irregular cross-bands of black or very dark brown; two of these bars broken, but the bars not divided into spots as in *L. barahonensis*; the first, second, and third bars continued on the sides of the head to form three vertical bars as in *L. barahonensis*, but better defined. Center of abdomen a brilliant yellow, sides of abdomen washed with grayish and studded with a series of azure blue spots; base of the thighs suffused with pinkish.

Length, 188 mm.; body, 76 mm.; arm, 27 mm.; leg, 57 mm.; head-length, 21 mm.; head-breadth, 15 mm.

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